SCIENTIFIC AMERICAN

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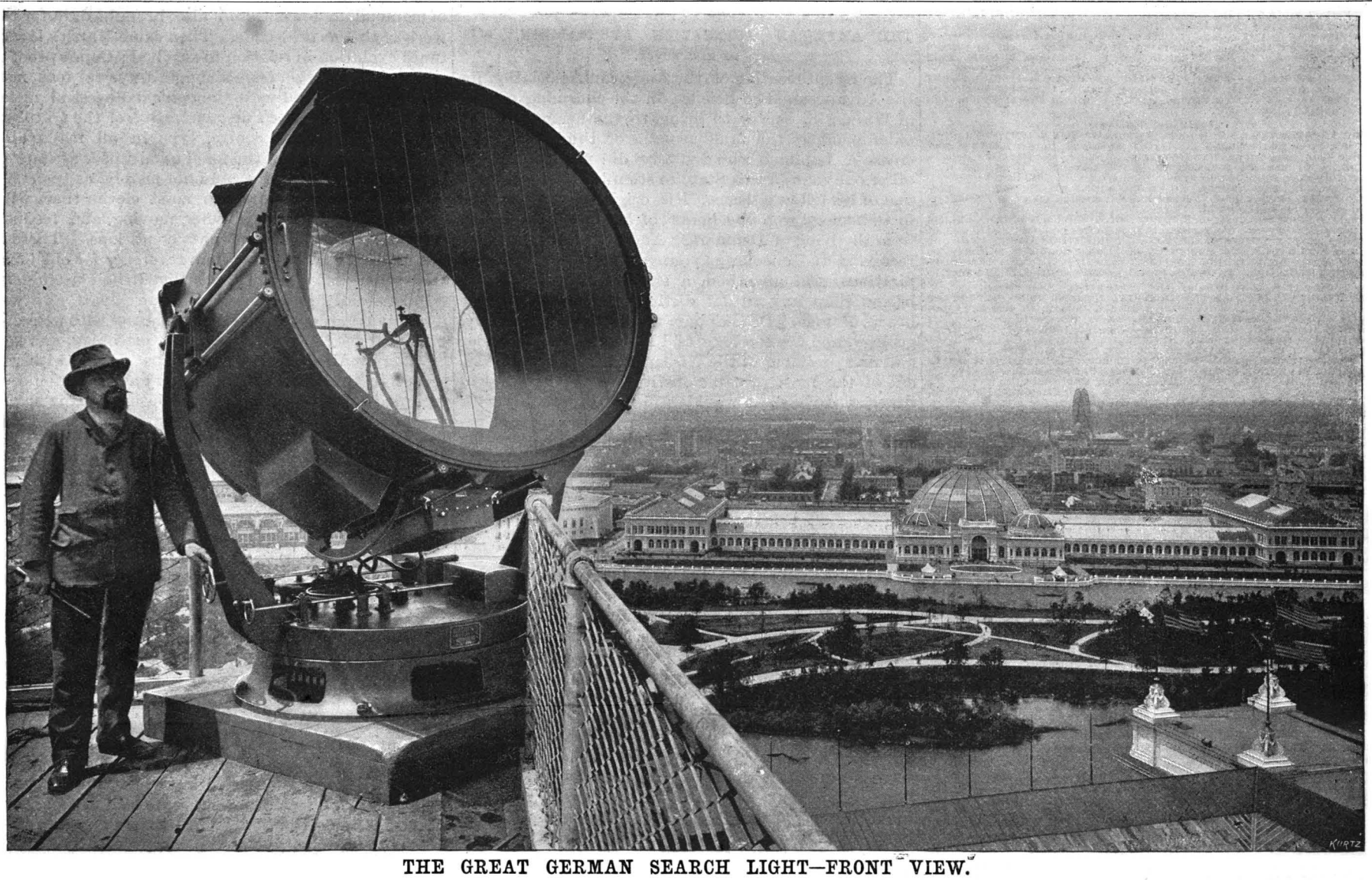
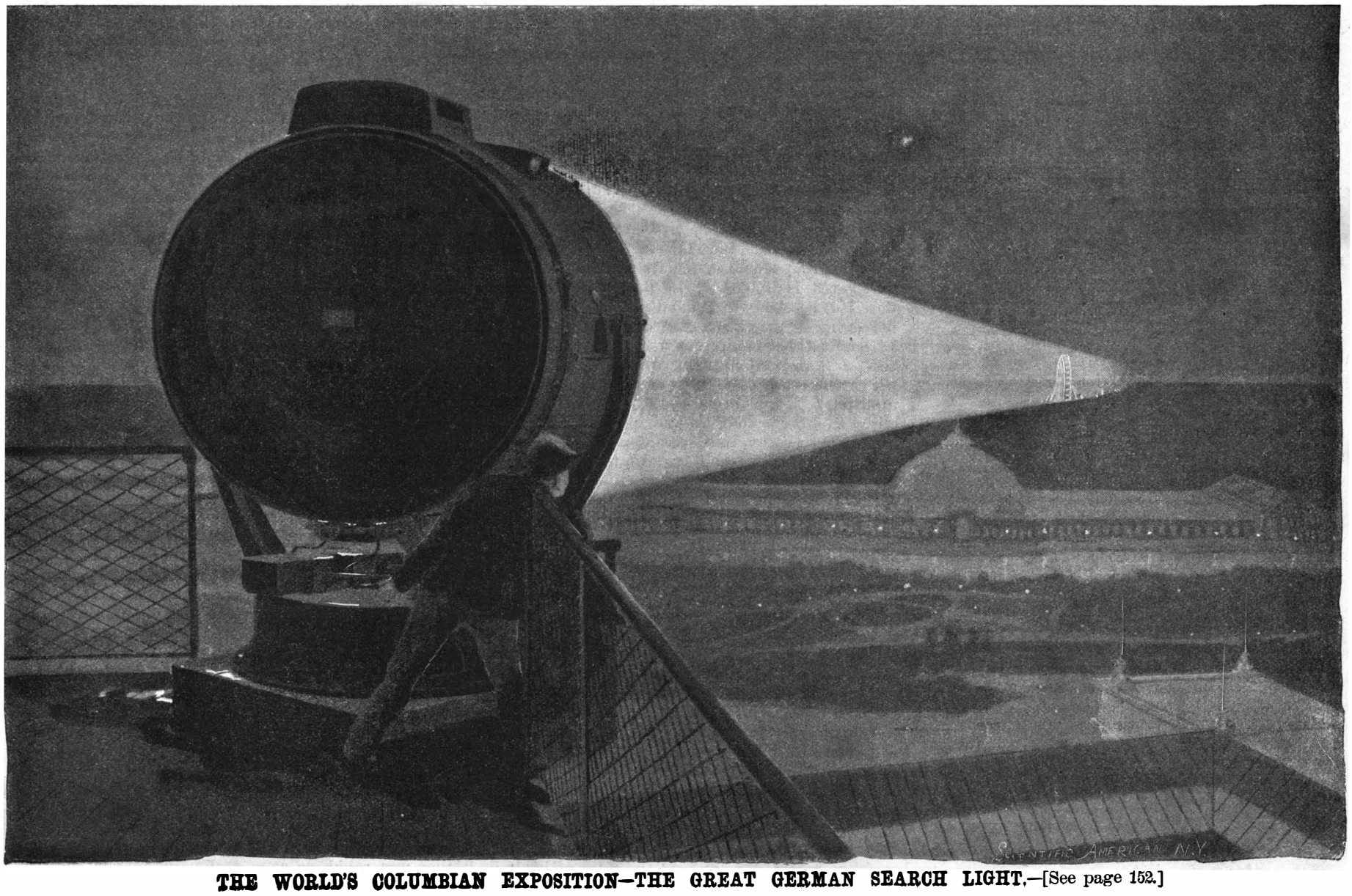


THE GREAT GERMAN SEARCH LIGHT—FRONT VIEW.



THE WORLD'S COLUMBIAN EXPOSITION—THE GREAT GERMAN SEARCH LIGHT.—[See page 152.]

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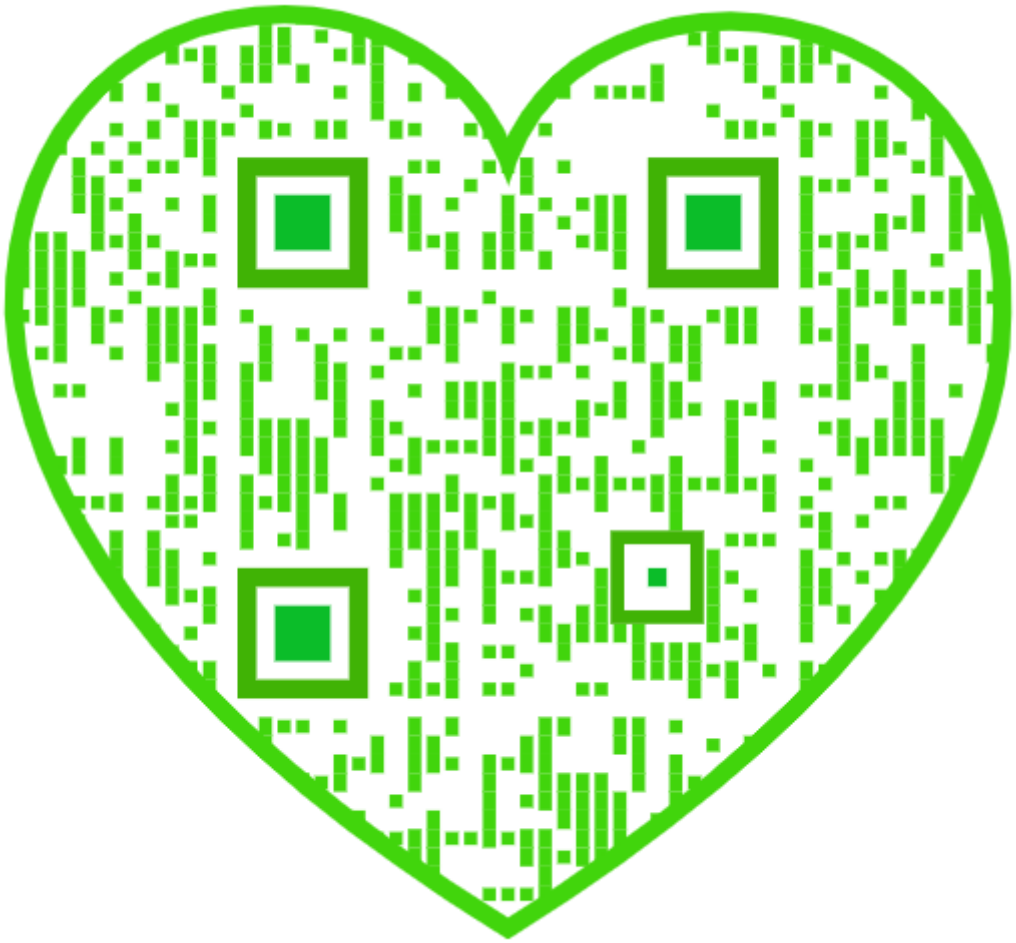

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PATENT OFFICE EXAMINERS WANTED.

Strange to say, there appears to be a greater demand for qualified persons to serve as Patent Office examiners than there are applicants. This probably is because the position demands considerable scientific knowledge, only to be acquired by thorough study, and ability to make intelligent use of such knowledge in the performance of official duties. Applicants for examinerships in the Patent Office must pass examination before the Civil Service Commission, Washington, D. C., who will furnish blanks and instructions. The subjects of the examination are: Physics, technics, mathematics and chemistry, and mechanical drawing. The salary of the position is $1,200 per annum.

THE AMERICAN ASSOCIATION AT MADISON, WIS.

BY H. C. HOVEY.

The recent meeting of the American Association for the Advancement of Science, in the charming capital of Wisconsin, serves to bring to the memory of the older members the familiar name of the late Dr. Increase A. Lapham, who doubtless did more than any other one man in this State to stimulate the scientific zeal of his fellow citizens. His original investigations in archeology won the honor of knighthood for him from the King of Denmark. And his promptness to recognize and encourage younger men of scientific aspirations, and give them a start in life, won what is better than any titular distinction—a place in the hearts of men. Dr. Lapham was eminent in botany, geology, and meteorology, and he was also the founder and first president of the Wisconsin Historical Library, one of the most valuable institutions of its kind in America. Indeed, he was identified so thoroughly with every scientific interest of the State as to make it peculiarly fitting that a tribute should be paid to his memory preliminary to mentioning the words and deeds of other men who, for several days have crowded the corridors of the State University and interchanged their facts and theories.

THE ORIGIN OF MOUNTAIN RANGES.

One of the most interesting and attractive persons in attendance this year, was the retiring president of the A.A.A.S., the veteran geologist, Professor Joseph Le Conte, of California. The subject of his annual address was "The Present Status of Science as to the Origin of Mountain Ranges." Mountains are focal points of geologic interest and theaters of intense igneous, aqueous, and eruptive agencies. Their strata vary in thickness from 10,000 to 50,000 feet at the crest (allowing for erosion), but slope away with diminishing thickness till they vanish in the valleys and plains. Their component materials are fragments of rock, coarse gravels, and sands, and their huge mass rises in folded structure above the general surface of the globe. Sometimes, as in the Uinta Mountains, there is but a single enormous fold; and again there is fold upon fold; and yet again there is occasionally great complexity, the strata being thrust under and over in a vast fanlike form. There are also sinclines and anticlines, which are often greatly appressed, as in the Appalachian range, where nineteen have been counted in a distance of sixty-five miles. Mountain strata are not equally affected by cleavage, some seeming to be very solid, while in the case of others the whole mountain appears to be cleavable from top to bottom. The earth wave sometimes breaks with surprising abruptness, and again it slopes away very gently.

Many theories have been offered in explanation of these phenomena. Bare facts are not science. Facts must be grouped and systematized. But as this work goes on, it is liable to grow daring and speculative, until it is necessary to demand a careful discrimination between what may be styled formal and causal theories. It is agreed that mountains were originated by a process of horizontal mashing and vertical uplifting of the earth's crust. But what caused this mashing and uplifting? A true formal theory must advance gradually. Mountains are born of sea-margin deposits. We find by observation that existing off-shore deposits are coarse at the top, shading down to fine, by the same law as that marked in the structure of mountains. But the enormous mountainous deposits would have been possible only where there was a corresponding subsidence of sea bottom. The earth sinks by loading and rises by unloading. Of this the Colorado plateau furnishes an illustration. It was originally 20,000 feet high, but 12,000 feet have been removed by erosion, which has caused the remaining 8,000 feet to rise above the general level. It may be regarded as now proved that the cosmic behavior of the earth is that of a rigid solid. A solid globe of glass, six feet in diameter, will change shape by the pressure of its own weight. The earth does the same. But as the earth is not homogeneous, its radial contraction will be unequal, and hence there will be ridges. The contraction theory assumes that the earth was once an incandescent ball, now cooling; and this cooling compels yielding along its lines of weakness. This is known abroad as the "American theory," and the author of this address was its originator. In conclusion, Prof. Le Conte said he was ready, if need be, to sacrifice "the child of his brain," but did not really think it necessary. He considered and refuted objections; and he finally returned to the contraction theory, not as demonstrated beyond a doubt, but as furnishing the best working hypothesis yet offered.

MAMMALIAN PALEONTOLOGY.

An elaborate an important address was given by Prof. H. F. Osborne, of New York, on recent progress in the study of ancient forms of mammalian life. A new era was opened twenty years ago by Kowalevski's memoirs on the hoofed mammals. At about the same time Leidy, Marsh, and Cope began to explore the ancient lake basins and found them rich in life. The first ten years of these twenty revolutionized our ideas of mammalian descent, and also brought data for the work of the next decade. Then came Marsh's law of brain evolution in relation to survival; Cope's proof of ungulate derivation from a simple ancestral foot resting on the sole, and with the conical ancestral molar tooth; and also Cope's demonstration of the tri-tubercular molar as the central type in all mammalia. We have learned that the fossil quadrupeds are now to be treated biologically, and not merely as petrified skeletons. The imagination must clothe them with flesh and behold them as living, moving, and feeding. New discoveries produce new conditions. There is nothing more obstructive than reverence for old ideas and systems after they have outlived their usefulness.

Paleontology is no longer a science apart, as it was formally regarded. It must keep abreast with geology, historical geography, paleobotany, osteology, and embryology. All structures should be studied with reference to their homologies. Every animal should be regarded as a whole and in its relations. How many toes an animal has is of less importance than how those toes are being displaced and reproduced. Our five fingers are a reptilian legacy; and the teeth of all animals cluster around a simple reptilian type.

General faunal succession of Mesozoic and Cenozoic time is marked by the sudden appearance and disappearance of certain series and the rise and fall of great groups. One of the most decided reforms in classification is in the use of the family division. It used to be the idea that families must be grouped as if in circles. But now they are regarded as in vertical lines, giving off branches. A horse, dog or lion is such from the moment he clearly appears to be such. In other words, we deal not with great separate lines of descent, but with stages of evolution in the same or parallel lines. The evolution of a family is simply an uninterrupted march in one direction. A certain trend leads to a final issue; but extinction or survival of the fittest exerts no influence en route. These changes en route lead us to believe either in predestination or in kineto-genesis. The trend of evolution is not the happy result of many trials: but it is heralded in structures of the same general form the world over, and in age after age by changes advancing irresistibly from inutility to utility. It is an absolutely definite and lawful progression. Fortuity is precluded.

Several papers will now be reported that had a bearing on the age of the globe and the length of time it has been inhabited; and the excited and animated discussion of these topics may be regarded as the most marked feature of this meeting of the A. A. A. S. The discussion was indeed originated at least a year ago, that is in its present form, and there is evidently a wide divergence of opinions, as well as considerable dispute as to facts.

GEOLOGICAL TIME.

In treating of geological time, as indicated by the sedimentary rocks of North America, Professor C. D. Walcott, of Washington, D. C., conceded, at the outset, that it is uncertain and is in conflict with the teachings of some other sciences. The physicist, for instance, requires us to bring terrestrial time within the extreme limit of twenty or thirty million years. The geologist replies that he cannot bring his facts within such narrow limits. Sir Charles Lyell, basing his estimate on modifications of certain species of marine life, assigned 240,000,000 years as the required length of geologic time. Darwin claimed 200,000,000 years; Crowell, about 72,000,000; Geikie, from 73,000,000 upward: Alexander Winchell, but 3,000,000; McGee, Upham, and other recent authorities claim from 100,000,000 up to 680,000,000 years. Notwithstanding this wide divergence, all agree in thinking the duration of the globe so great as to make man's occupancy of it seem but a span.

The attempt in Professor Walcott's paper was to throw light on the problem from ascertained facts as to the evolution of our continent, which was outlined in the Archean period and has not materially changed since. Its areas were more clearly outlined in Algonkian time, since which the changes have all been above the level of the deep seas. Sedimentation as the result of denudation has continued with little interruption. During the Upper Cambrian time the broad Mississippi area was worn down and the mass removed was carried into the ancient Cordilleran Sea. The processs then was rapid, as compared with similar work in

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other periods. Chemical denu lation is by the taking up of material in solution. Murray, in describing the results of the Challenger expedition, says that 113 tons per square mile per year may thus be accounted for. Besides the lime, etc., precipitated from solution, there have been mechanical processes going on, as also the agency of organisms. Most of this has been in comparatively shallow water. There is no evidence of the continental marine deposits having been made in deep seas.

Without following the steps in detail, it may be said that the conclusion reached by Professor Walcott distributed geologic time as follows:

Cenozoic (including Pleistocene), about	2,900,000 years.
Mesozoic	7,240,000 "
Paleozoic	17,500,000 "
Algonkian	17,500,000 "
Total time of sedimentary rocks	45,500,000 "

In commenting on this table it should be said that the data for Archean time are doubtful. Also there are no sufficient data from the duration of animal life to fix geologic time back of about 10,000 years. The fact may be mentioned that while we have 55,000,000 square miles of land, there are 137,200,000 square miles of water.

The conditions on which denudation and deposition went on were given with minuteness and a formidable array of figures. As a specimen of Walcott's reasoning, it may be said that the rocks in the great interior basin of Nevada, Utah, etc., are 21,000 feet thick, and cover an area of 400,000 square miles. The limestones are 6,000 feet thick, and the sandstones and shales 15,000 feet. At the estimated rate of deposit in the ocean of the present day it required 1,200,000 years for the limestones of that area and 16,000,000 for the sandstones and shales, or 17,500,000 in all. With this as a unit, the tabular results were reached already given. In other words, as compared with the conclusions of other geologists, Walcott would measure geologic time, not by hundreds of millions of years, but simply by tens of millions.

THE EARLIEST MEN.

Profound interest was awakened by Dr. Daniel G. Brinton's address on "The Earliest Men." How did they come into existence? By special creation. Everything is special. The whole species is made up of special individuals; and their evolution is multiform. Scientific men are agreed that the human race did in some way arise from some inferior animal form—not necessarily monkeys. The transition may not have been gradual, but abrupt—evolution per saltum. We do not find the "missing link;" it is still missing; it may be forever missing. There are different opinions as to how many early men there were. There may have been several distinct centers, but science as well as orthodoxy points toward the conclusion that all men originated from one primal pair living in one definite place. When did these early men appear? A perplexing question. We used to be told that it was 6,000 years ago; but we now know that there were at that time thousands of men living in Europe, Asia, Africa, and America. It may be that we have misunderstood the Biblical record, or that it may have concerned a single branch of the race. It is certain, however, that man appeared late in the geological history of the globe. Human remains have been found in half a dozen places in the world under circumstances that seem to show that man lived in the Tertiary age: but the proof really seems meager. Did man appear during the great Ice Age? The testimony from ancient caverns whose mouths had been sealed by drift, and whose contents lay hidden under stalagmitic floors, as well as that gathered from stratified gravels and other sources, proves that man probably did inhabit the globe during or even before the Ice Age. The date of that age is not exactly fixed, but was probably about 50,000 years ago, altnough some men of science have assigned a less and others a greater period than this.

Where did the earliest men make their home? Manifestly there were certain conditions requisite. Man requires food and generally some kind of clothing. We may reason by exclusion. The first men did not inhabit an island, for they could never have got off. They did not live where it was very cold, because they would have perished. The greater portion of the northern hemisphere was under water at the time of their advent, hence that is ruled out. They could not have lived in Australia nor in Southern Africa on account of climatic conditions and for other reasons. In short, we find them limited by conditions to the area between the Himalayan Mountains and Spain. Practically the oldest remains yet found have been discovered in the most densely inhabited regions of Europe. The sacred record treats of a particular line of human beings. The fable of the lost Atlantis and the theory of Haeckel as to the submerged Lemurien are not tenable. Eurasia was certainly man's original birthplace.

What did the early men look like? Were they altogether rude? Did they creep on all fours or walk erect? The most expert anatomists have decided, after examining the ancient bones that have been exhumed, that there is no more difference between ourselves and those early men than there is between ourselves now. They were doubtless sturdier. They did not trouble themselves as much about dress as we do. They had reddish hair and probably a ruddy complexion, with blue or gray eyes. Their skulls were about as good as ours, except the famous one of Neanderthal, for which we have less respect than we used to have. In a word, they were men. They knew how to make a fire. Even the very oldest of all men knew that wonderful art. They also knew how to make tools from stone, wood and horn. They were conversant with a variety of instruments and tools. They had weapons with which they killed huge animals. They knew about boats. They had dwellings. They were socially inclined and lived in communities. They were brave and had wars. They endured hardships. They had good hearts and loved one another. We have positive proof that they took care of the aged and nursed the invalids among them. They had some kind of language and knew something of music. We cannot positively say that the very earliest men worshiped, but if they did so, their worship was spiritual. They had no idols. They had some sense of beauty. They decorated shells. They carved the horns of reindeer and tusks of mammoths. Those first men could travel rapidly. They encountered no very dangerous enemies. We can easily see how there came to be varieties among them, for more changes are now going on than ever before. All shades, from black to blond, are easily explained. We may safely conclude that the early men were essentially human and very much like ourselves, with hearts and brains, hopes and fears, woes and aspirations like our own.

THE EVIDENCE OF GLACIAL MAN IN AMERICA.

The A.A.A.S. inherited from the Rochester meeting a lively discussion between Professors G. F. Wright, W. J. McGee, and others, concerning the proofs of the high antiquity of the human race on this continent. For hour after hour the discussion proceeded, and other sections adjourned to hear the war of words. It is not easy to convey the exact idea of the situation to the mind of the reader unless he has kept up with the recent literature on the subject. It is well known that in various localities in France, England, and elsewhere in Europe, remains have been found that were regarded as decidedly glacial, although there is not perfect agreement even as to these evidences. However, it was perfectly natural for our own geologists and anthropologists to seek for similar finds in this land. Foremost among such explorers may be named Dr. C. C. Abbott, of Trenton, N. J. This gentleman lived right on the glacial gravels, which were being extensively excavated by railroad men and others, and kept a careful watch. His first finds awoke such skepticism as to lead to the suspicion that he manufactured them himself. Even Prof. Dawkins, of England, spurned them at first, until he was induced to look for himself, when his doubts were removed. Prof. G. F. Wright, who is a renowned glacialist, and Prof. F. W. Putnam, of Cambridge, Mass., whose fame as an anthropologist is established, accept Dr. Abbott's findings as genuine. In an able paper Prof. Wright protested against the prevailing tendency to over-skepticism concerning archeology, and contended that evidence ought to be satisfactory that would satisfy a jury sitting in a case of life and death. Accordingly he has been busy sifting the testimony as to the Trenton gravels, and gave his results in the aforesaid paper. He says that in examining about 5,000,000 cubic yards of gravel Dr. Abbott found twenty paleolithic implements in place in the undisturbed strata, and several hundred in the debris. His testimony is explicit and reliable. Other implements were found by Putnam, Shaler, Carr, Pumpelly and Whitney, as well as by Wright himself. The conclusion of these scientists is that the argillite implements were more ancient than those made of jasper, and that some of them were as old as the glacial drift. The upper stratum of soil is about a foot thick and contains many jasper relics, also those of argillite; but only the latter are found in the lower strata. Doubts have been expressed by some as to whether these are artificial or natural; but as the specimens were exhibited before the A.A.A.S., the members could judge of that for themselves. Dr. Holmes, an eminent archeologist, visited Trenton with negative results; but he worked under unfavorable conditions. Prof. Wright gave a careful *resume* of the entire matter, and compared with ascertained results the discoveries in Ohio and California, as well as abroad, and pronounced the evidence to be convincing as to glacial man in America.

Prof. Putnam, Prof. Chamberlain, Prof. McGee, and others, took a lively part on the discussion that ensued, giving the results of their own observations, and weighing the testimony given by their fellow scientists. The rules as laid down by McGee were certainly good, to the effect that when any object of unusual form and unknown origin is found in geological strata, the presumption is that it is natural rather than artificial. He also said that legal and scientific demonstration differ. In courts conclusions must be reached and must be final. Hence, with the utmost care, they may be in error. In science it is not necessary to hasten to a final conclusion. Science can wait. It is also desirable that evidence should be both unimpeachable in quality and abundant in quantity. The question of the antiquity of man is so highly important as to make sweeping conclusions undesirable. He regarded the Trenton testimony as interesting but tantalizing, because not absolutely conclusive. We do not have to hurry along to a conclusion. Let us patiently accumulate materials, not merely from one individual, as Dr. Abbott, nor from occasional visitors, but from all sources. Let us examine the paleolithic specimens more carefully to see if they are really in place, and if they are tools or "rejects." Then when all the evidence is in, we can probably arrive at results that will be satisfactory to the scientific world at large.

Taking into consideration the eminence of the men engaged in this friendly controversy, and the earnestness with which they defend their widely varying views, the expectation is that more may be expected from the same source in connection with the approaching Anthropological Congress at Chicago.

The Incubation Periods of the Infectious Diseases.

The Clinical Society of London has recently published the result of extensive observations regarding the period of incubation of some of the infectious diseases. A constant period of incubation is not to be expected. In most instances it will be seen from the following table that the difference in the maximum and minimum period is not very great. It seems remarkable, however, that a disease should show such extremes as typhoid fever:

	Normal.	Maximum.	Minimum.
Variola	12 days.	14 days.	9 days.
Varicella	14 "	19 "	13 "
Measles	10 "	14 "	4 "
Rubella	18 "	21 "	8 "
Scarlet fever	2 "	7 "	1 "
Influenza	3 "	5 "	1 "
Diphtheria	2 "	7 "	2 "
Typhoid fever	12 "	23 "	5 "
Mumps	19 "	25 "	12 "

It is a peculiar fact that the diseases in which the period of incubation is shortest are those in which the infection may persist the longest. The period of quaratine must be governed largely by the period of incubation, hence the subject is an important one for a variety of reasons. Dr. Dawson Williams, commenting upon these figures in the *Medical Magazine of London* for June, states that the period of quarantine should be at least a day longer than the maximum for each disease. This is a very uncertain rule, however, for the patient should be free from all signs of illness, and especially from fever. The necessity for disinfection of clothing is shown by cases reported in which persons wearing garments which had been exposed to infection have escaped, while others coming in contact with the same clothes have contracted the disease. This is probably explained by the great susceptibility of certain persons to particular diseases. The period of infection is very doubtful. It may be greatly prolonged by some complication. This is especially true of smallpox, diphtheria, typhoid fever, and scarlet fever. The period during which a disease may be infectious cannot be stated definitely. It varies with different cases, and must be determined according to the nature of the symptoms and the character of the case. Measles, chicken-pox, and mumps lose the direct power of infection very early, and the infective principle does not remain active for a long period in the room in which the patient has been ill. Measles, mumps, and chicken-pox may be infectious in the earliest stages before definite or characteristic symptoms appear. Smallpox, fortunately, is not actively contagious until the eruption has appeared. This statement, the committee affirms, has been proved by abundant observation.—*N. Y. Med. Jour.*

Comparison of Power between Carbonic Acid Gas and Compressed Air.

The results of calculations show that, for a given tank capacity and carbonic acid and air stored at the same pressure, the (liquefied) carbonic acid is capable of developing four to five times more power than compressed air. If a compound engine is employed, and the gas or air is heated so that the temperature at the beginning of expansion is 383·5° Fah., the carbonic acid engine requires 21·6 pounds of carbonic acid per hour per horse power, and the air engine 14·3 pounds of air. On this basis of 21·6 pounds of carbonic acid per hour per horse power, we can determine the price it would have to be sold at to be an economical power.

If the carbonic acid is exhausted into the atmosphere, the cost is much too great for ordinary power purposes. If the exhaust is condensed, the engine will have the same theoretical efficiency as an engine using any other vapor through the same range of temperature, and the working pressures will be very high, so that practical difficulties are met with. Experiments with carbonic acid gas engines, in which the exhaust is condensed, have verified the conclusions pointed out by theory.—*Prof. D. S. Jacobus.*

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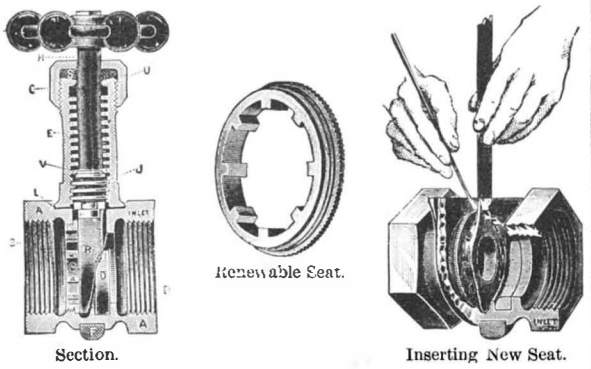
THE "LUNKEN" GATE VALVE.

The illustration represents a valve of great strength, whose seat is renewable without disconnecting from pipes, which has been placed on the market by the Lunkenheimer Company, of Cincinnati, Ohio. Its disk is balanced, thus operating easily regardless of high pressure, and it has been found in practice to possess superior merit as a reliable straightway steam valve. The valve can be easily taken apart without renewing the packing washer, and it is furnished with a renewable seat, at small cost, whereby in a few minutes a worn-out valve can be made practically as good as new.



THE "LUNKEN" GATE VALVE.

BEVEL GEARING CUT THEORETICALLY CORRECT.

The display in Section 15, Machinery Hall, of the World's Columbian Exposition, made by Hugo Bilgram, of Twelfth and Noble Streets, Philadelphia, Pa., is very notable, and illustrates the perfection that has been attained in the production of cut bevel gear wheels. In addition to numerous bevel and miter wheels, ranging from 1 inch to 30 inches in diameter, two pairs of miter wheels are exhibited, driving overhead shafting set at right angles, and several sets, embracing every variety of bevel wheels, are mounted on stands, to be examined by hand, as to the smoothness of running and the absence of backlash. The wheels overhead, although running at a high speed, make very little noise indeed, and an examination of the mounted wheels will convince any one conversant with the difficulty of cutting bevel wheels, that a further improvement in this line is hardly conceivable.

Among the mounted wheels there are two sets which are of special interest to the student of kinematics, and are illustrated in detail. One is a pair of miters with teeth cut inclined, with the object of having at all times at least one tooth in deepest gear. The other is a set of four, namely, one wheel of 36 teeth and three pinions having 12, 18, and 24 teeth respectively, the pinions meshing at right angles with the wheel. Most authorities on gearing have heretofore considered this theoretically impossible; but the exhibited wheels show that it is both theoretically and practically possible, for the wheels, which can be turned by hand, run smoothly and with practically no backlash.

The Great Enemies of Man.

The change in the conception of tuberculosis, produced by a discovery of its true cause, calls for a reconstruction of many of the heretofore approved statistics of mortality. It is not very long ago since text books stated that tuberculosis, meaning especially pulmonary consumption, affected most often persons between the ages of fifteen and thirty years. The tubercular infection is now known to be most frequent as a cause of death in infancy. At this time it is the mesenteric and other lymph glands and the meninges that are involved; in childhood the bones are prone to be attacked, in adult life the lungs.

Taking tuberculosis in every form as a cause of death, Professor Hugo Holsti, of the University of Helsingfors, has compiled interesting facts showing the relation of age to this disease.

During the years 1882-1889 there died in the Swedish district of Helsingfors 1,771 persons of tuberculous diseases. The mortality rate per 10,000 living persons is much the greatest during the first two years of life (2·5 per cent). It rapidly falls until, between the ages of six and fifteen, it hardly exists (about 0·15 per cent). It then steadily rises until the decades thirty-one to forty, forty-one to fifty, and fifty-one to sixty, where it remains at about 0·6 per cent and then falls again.

Males are more subject than females in the proportion of 990 to 781, but this holds true more for adult than infant life.

Professor Holsti's tables show in a striking way identity of the period of greatest mortality from tuberculosis with the time when children are fed on milk.

May it not be that, after all, the cow is the great enemy of mankind, and that without the cow there would be no tuberculosis? The history of Japan, which is a cowless country, favors in a measure this view. Science seems to be pointing toward the conclusion that there are two great and potent poisons constanly diffused among civilized peoples, and these are milk and water. Not that these substances are essentially bad, but that they are accidentally so. It is not proposed to abolish, but to purify them.—*Medical Record.*

The New Revenue Cutter William Windom.

The William Windom is a new revenue cutter intended for use at the port of Baltimore. This vessel, which is now being built at Dubuque, Ia., at a cost of $98,500, has many new features. The Windom is 171 feet long, 27 feet wide and 13 feet deep. Her engines will be triple expansion twin screw, a new departure for a revenue cutter. Steam is supplied by a Scotch marine boiler weighing 60,000 pounds. There will be a cabin on the main deck, handsomely finished in cherry and mahogany.

How Congressmen Choose Their Seats.

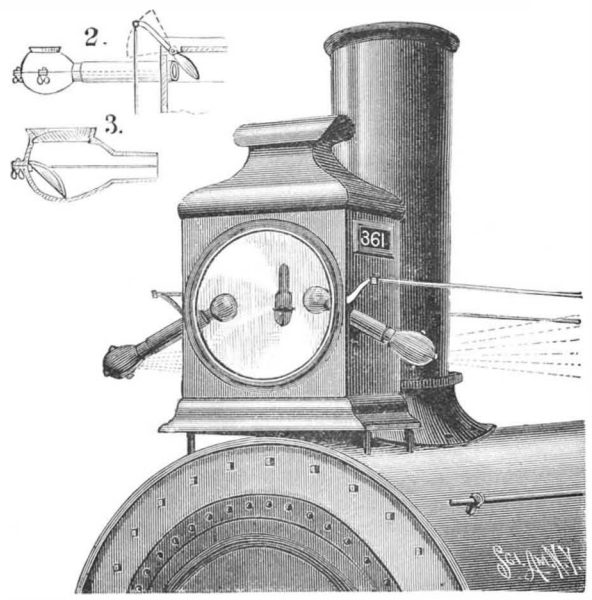
The following are the rules of the House in respect to the selection of seats:

1. At the commencement of each Congress, immediately after the members and delegates are sworn in, the clerk shall place in a box prepared for that purpose a number of small balls of marble or other material equal to the number of members and delegates, which balls shall be consecutively numbered and thoroughly intermingled, and at such hour as shall be fixed by the House for that purpose, by the hands of a page, draw said balls one by one from the box and announce the number as it is drawn, upon which announcement the member or delegate whose name on a numbered alphabetical list shall correspond with the number on the ball shall advance and choose his seat for the term for which he is elected.

2. Before said drawing shall commence each seat shall be vacated and so remain until selected under this rule, and any seat having been selected shall be deemed forfeited if left unoccupied before the call of the roll is finished, and whenever the seats of members and delegates shall have been drawn, no second drawing shall be in order during that Congress.

A LIGHT REFLECTING APPARATUS.

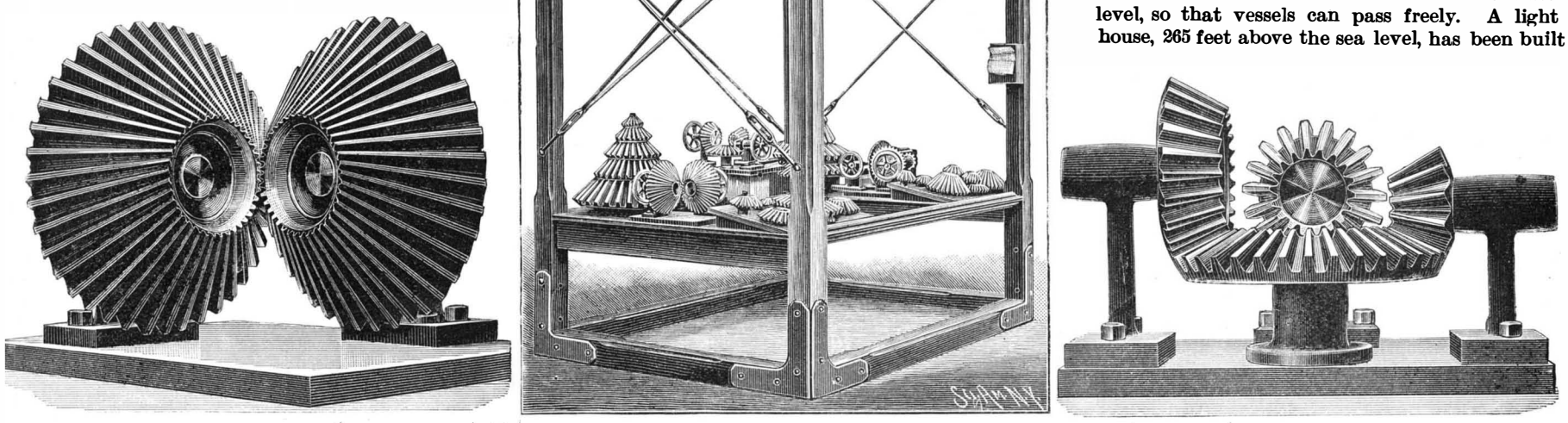
A device to facilitate the direction of light in different paths from a central point is shown in the illustration, the improvement being shown applied to the head light of a locomotive. The invention has been patented by Messrs. Arthur B. Moore, George W. Rue, Coral D. Smith, Frank H. Roebuck, John F. Mills, and John R. Kirk, of East Las Vegas, New Mexico. In the sides of the lantern are inserted tubes to the inner ends of which are hinged concave reflectors, as shown in Fig. 2, and with which are connected levers pivoted to rods extending to the cab of the locomotive. In the outer ends of the tubes are inserted the necks of the light distributors, shown in section in Fig. 3, there being in the side of the casing an aperture in which is a plano-convex lens, while within the casing, opposite the opening of the neck, is a convex reflector, arranged at an angle of forty-five degrees to the axis of the neck. The light is reflected by the inner concave reflectors through the tube upon the outer convex reflector, which reflects it through the plano-convex lens in the side of the casing. The inner concave mirrors are adjusted by means of the rearwardly extending rods so that the light may be sent in any required direction.



AN IMPROVED LIGHT REFLECTING APPARATUS.

Opening of the Corinth Ship Canal.

The Corinth ship canal, connecting the Gulf of Lepanto with the Ægean Sea, was formally opened on July 29, in the presence of the Grecian royal family, the court, and representatives of the army, navy, and also foreign diplomats. The first sod of the canal was cut by the King of Greece in April, 1882. The company which held the concession was originally French, but work was suspended in March, 1890, owing to the financial crisis in Paris, and the canal was then transferred to a Greek company, under which it was finally completed. The canal is three and nine-tenths miles long and the minimum depth is 25 feet, while the average breadth is 100 feet. A bridge crosses the canal about a mile from the west end and is 230 feet above the water level, so that vessels can pass freely. A light house, 265 feet above the sea level, has been built on the isthmian ridge, so that its light can be seen from both directions. The canal is protected by breakwaters, on which are lighthouses. Steamers from the Adriatic, bound for Constantinople, will save eighteen hours by the new canal, and steamers from Marseilles will save eight hours.



THE WORLD'S COLUMBIAN EXPOSITION—BILGRAM'S EXHIBIT OF CUT BEVEL GEAR WHEELS.

IT has been estimated that 25,000 horses are employed in the London carrying trade, that their value is £1,250,000, and that the cost is, for food, £800,000 a year. A rule prevails of foraging the horses on threepence an inch per week—that is, a horse costs as many shillings a week as it stands hands high.

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CONDENSED MILK REPRESENTED AT THE FAIR.

The very handsome exhibit of the New York Condensed Milk Company, in Agricultural building, most appropriately bears, in prominent position on its four sides, representations of the distinguished inventor, Gail Borden, the exhibit being crowned by an eagle, the well known trade-mark of the company. The first patent for condensing milk was granted to Gail Borden in 1856, and in the same year were established the first works for carrying on the business. The demand for the product for the use of the soldiers during the war of the rebellion caused the rapid enlargement of the business at a very early day, but its great merit became then so fully recognized that the increase in demand has been continuous, as is evidenced by the extraordinary development of the great company now marketing these productions. The milk is condensed *in vacuo* and sterilized at several great establishments located in the best dairy districts of the country, as in Westchester, Putnam, Dutchess, Orange, Ulster, and Chenango Counties, New York State, and in the best dairy country around Chicago. The company has the most stringent rules governing the dairymen from whom it buys milk, its contracts with the farmers allowing the company to exercise such supervision over the production and care of the milk as to guarantee purity and evenness in quality, the utmost care and cleanliness being considered an absolute essential. In each of its plants the company makes its own boxes and cans in which the product is packed, so that the works in each case constitute extensive industrial establishments. In New York, Brooklyn, Jersey City, Newark, and Chicago, the fluid milk is also supplied by wagons making daily deliveries, the facilities of the company for obtaining the best dairy product, as required for condensing, having invited the organization of this branch of the business. The company's wagons are now delivering milk direct in this way daily to over 60,000 families. The growth of the business, great as it has been, has been due solely to the superior merit of the products.

A Coal Dust Engine.

A novel motive power engine has been invented, based upon the fact that very finely divided carbon, floating in the air, readily explodes, and to adapt this to the generation of motive power the inventor proposes to grind coal to an impalpable powder, and, after introducing the dust floating in the air into the cylinder of an engine, explode it, the idea being to follow very much the same lines which are being so thoroughly developed in the use of gas in engine practice. The first difficulty which suggests itself is how the ash is to be got rid of, but experience in gunnery shows this may not be a serious obstacle.

EXHIBIT OF THE DIXON CRUCIBLE COMPANY AT THE FAIR.

The Joseph Dixon Crucible Company is the only concern in the world which manufactures every article of which graphite is a component part. With the invention by Joseph Dixon in 1827 of the plumbago crucible, the crucible business was revolutionized. At that date began also the manufacture of Dixon's stove polish, foundry facings and the development of an industry now grown to enormous proportions and fittingly represented by the Joseph Dixon Crucible Company, of Jersey City, N. J.

This company has two exhibits at the World's Columbian Exposition. One is of Dixon's American graphite pencils, in the northeast gallery of the Manufactures building, and the other, covering all the other articles manufactured by them, in the northeast gallery of the Mines and Mining building. The pencil exhibit occupies a space 10×14 feet. In the center of this space stands a low mahogany table surmounted by a pyramid of velvet, which is covered with pencils arranged in graceful and beautiful designs by an artist employed specially for that purpose. Over this pyramid stands a rosewood and plate glass case. Two ornamental facades of turned and carved mahogany front the space, which is separated from neighboring spaces by means of Japanese bead curtains, suspended from carved grilles. The space is lighted at night by means of two gilt electroliers of six 16 candle power lights each.

The company's exhibit of general and special graphite products in the Mines and Mining building occupies a space 25×28 feet. A very handsome cherry facade fronts the space, while the sides are hung with tastefully arranged portieres. Crucibles, retorts, ladles, stopper heads and nozzles, graphite boxes, phosphorus chargers, resistance rods and devices, incandescent filament forms and other special goods made of graphite, are shown in upright cabinets. In another case is shown the development of an electrotype plate, in which process the use of graphite is an essential. In still another case are shown over fifty varieties of graphite, for as many different uses and under as many different names, such as graphite for lubricating, stove polish, foundry facing for green, dry or loam castings, core wash, ingot mould wash, shot and powder glazing, electrotypers', gilders' use, hatters' use, rubber packings, piano and organ actions, pot-leading yachts, for crucibles, lead pencils, paint pigment, lubricants, etc.

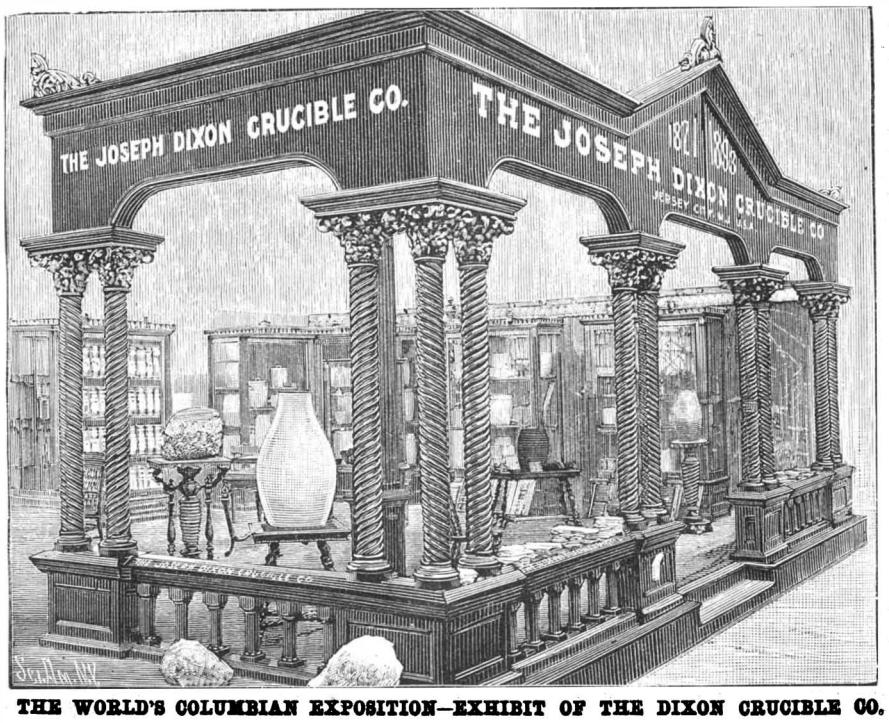
There are also shown samples of graphite from all the principal sources from which that article is obtained. One very fine sample from the island of Ceylon weighs nearly 300 pounds. There are comfortable chairs, with writing desk and stationery for the free use of those who may desire it.

The Dixon Company were the first to complete the installation of their exhibit at the Fair, and their promptness brought forth a highly commendatory letter from the chief of the department, F. J. V. Skiff.

THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE NEW YORK CONDENSED MILK COMPANY.

The Fastest Cruiser Afloat.

The new Japanese war ship Yoshino recently was subjected to steam trials. The mean of four runs on the measured mile gave her a speed of 23·031 knots per hour, or 26½ miles per hour, making her the fastest cruiser afloat. Her displacement is 4,000 tons, length 350 feet, 46½ feet beam, 15,000 H.P. Built by Armstrong, Mitchell & Co. Designed by Philip Watts.



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE DIXON CRUCIBLE CO.

The Tin Mines of Maliwun.

Mr. E. H. Parker, in the *China Review*, gives an interesting account of the tin mines and mining of the Maliwun Peninsula in the Mergui in the extreme south of Burma. Victoria Point, he says, is the southernmost extremity of the Indian Empire in this direction. The Pakchan River is for 50 miles or so the boundary between the British possessions and Siam. The population of the peninsular tract is entirely Siamese, Malay, and Chinese, and Burmese is as little spoken as Burmese faces are rarely seen.

A pathway has recently been made from Victoria Point up to Maliwun, which is the chief center of the tin producing industry, and this pathway also runs north of Maliwun to the highest point of sea-going steam navigation, but, with the exception of this path, the country is one dense mass of mangrove swamp and impenetrable jungle, the haunt of rhinoceroses, elephants, bisons, wild cattle, samburs, tapirs, tigers leopards, and other wild animals. On the opposite side of the river is Renong, a Siamese province under the rule of a Chinese rajah, whose intelligent government has changed the country from a mangrove swamp into a nutmeg garden and a tin manufacturing center.

The Pakchan River is very pretty, densely wooded hills in the distance on all sides form a very agreeable background to the tangled masses of virgin mangroves. The steamer enters a tributary called the Maliwun River to the left, but 17 miles from the mouth, and anchors a mile or two below Maliwun Creek, the haunt of alligators. Maliwun is a thriving village of perhaps 50 houses, mostly Chinese. There are two tin smelting houses, where during the smelting season seven hundredweight of tin can be smelted in a day by each furnace with four or five men. The total annual production of clean tin at present is about 50 tons a year.

The smelting apparatus is extremely simple, and is like that used by the miners of Perak. A mud furnace, just like a wine barrel, bound round and crossed with iron hoops, with a bellows consisting of a hollowed tree fitted with a piston, and connected with the furnace by a short bamboo tube let into a mud funnel, is all. The whole only costs about $25 when new. One man drags the piston and fro, but, as this is hard work, he has to be relieved every hour or two. Another man does the stoking, putting in the charcoal, tin, and slag for resmelting at the top. Out of a small hole in the bottom, on the side opposite the hole connected with the bellows, runs the tin, which is allowed to collect in a hole in the ground, and is then shoveled into two moulded holes in the sand, made by working a wooden mould, like a huge brick rounded on one side, into the sandy soil. Nothing could exceed the extreme simplicity and economy of the whole arrangements, and hitherto no foreign machinery has ever been able to cope with them for a moment in an economical sense. The chief smelter is a Malay-Burmese widow, who, after refusing several eligible suitors, including one or two Europeans, has at last bestowed her hand upon an industrious Chinese.

Farming for a Living.

Secretary Morton reminds the croakers that only about 3 per cent of all the merchants escape failure, whereas hardly 3 per cent of the farmers fail. The statistics really show that agriculture is safer than banking, manufacturing, or railroading, taking all things into account. There is no farmer of good sense and good health anywhere in the West, Mr. Morton declares, who cannot make a good living for himself and family, and that is as well as the majority of men are doing in any other pursuit. The man who owns a farm and sticks to it is certain to profit by it in the future. There is practically no more land to be added to the area of cultivation. The supply of agricultural products has reached its limit in the United States, and must now remain stationary, while the demand will go on increasing every year. This implies a gradual improvement in prices, and a steady appreciation of the value of farming lands.

TELEPHONEMETER is the new word naming an instrument to register the time of each conversation at the telephone from the time of ringing up the exchange to the ringing-off signal. Such a system would reduce rentals of telephones to a scale according to the service, instead of a fixed charge to a business firm or occasional user alike. The instrument has been constructed at the invitation of the German telephone department and is to control the duration of telephone conversations and to total the time.

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Recent Novel Experiments with Dynamite upon the Ocean Bar at Brunswick, Georgia.

The bar known as St. Simon's bar, prior to 1882, had from earliest knowledge of it an available depth of between 16 and 17 feet at mean low tide, of between 23 and 24 feet at mean high tide. A wreck closed this channel. A new channel opened to the north of the old, of 14 feet at mean low tide, 20·8 at mean high tide. The latter channel was closed to commerce by a wreck in 1889. The best available outlet remaining over the ocean bar was, in 1890 and spring, 1891, 11·5 feet at mean low tide, of 18·3 feet at mean high tide.

The commerce of the port was threatened with disaster. The municipal authorities, unable to secure immediate government aid, determined to undertake some measure of at least temporary relief, and sought to procure a dredge, failing in which, C. P. Goodyear, a lawyer, suggested explosions of dynamite sunk upon bottom of bar.

The trial commenced July 8, 1891. August 22, 1891, the depth obtained in a new and straight channel was 13·3 feet at mean low tide, 20·1 feet at mean high tide.

The author of the idea, under an act of Congress authorizing him to continue upon the "no cure, no pay" plan, has pursued the same methods, increasing the size of charges from 15 pounds to 50, then to 100, then to 200 pounds, exploding thus far 60,000 pounds of dynamite, and now has a channel across entire bar, with shoalest depths of 22·3 feet at mean high tide, which he expects to further deepen to at least 16·3 feet at mean low tide or 23 feet at mean high tide during the month of August. No shoaling has occurred at any point since commencement of the work. The gain already effected of 4 feet is certainly remarkable, and is a boon to the commerce of Brunswick. Further progress of this work will be watched with interest, as it will determine whether the author of the idea has made a great discovery applicable to ocean bars at other ports. The total expenditure thus far upon this work is understood not to have exceeded $30,000.

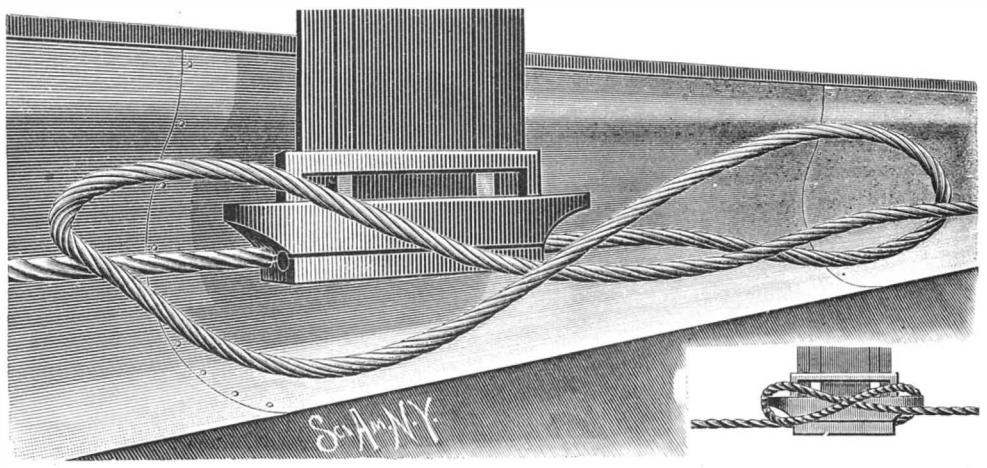
Bathing After Excessive Exercise.

The popular notion of the injurious effect of a cold bath taken by one who is overheated from exercise, must possess—as all such ideas have—some basis in experience; and yet it is falsified by the experiences of athletes from the days of the Greeks and Romans even until now, who find in this procedure a refreshing and stimulating tonic after the exertion they have recently undergone. And, physiologically speaking, a cold plunge or douche taken immediately after the physical effort, when the skin is acting freely and there is a sense of heat throughout the body, is as rational as in the experience of the athlete it is beneficial. It is paralleled by the tonic effect produced by the cold plunge when the skin is actively secreting after a Turkish bath, and finds its rationale doubtless in the stimulation of the nervous system, in the increase of internal circulation, and also in the renewal of activity to the cutaneous circulation after the momentary contraction of blood vessels due to the cold. The popular belief, doubtless, rests on the injurious effects which may be induced by the bath in one who does not resort to it immediately, but allows time for the effects of fatigue to show themselves on the muscles and nerves and for the surface of the body to get cool. Taken then the bath is more likely to depress than to stimulate, there is less power of reaction and greater liability to internal inflammations. At such a time a warm bath rather than a cold one is more suitable and more safe. It has been suggested, however, that the practice of indulging in a bath after violent exercise may initiate renal disease. Of this there is no evidence. The transitory albuminuria observed after prolonged cold baths may indicate the disturbance in the renal circulation which ensues upon them, but these cases are in a different category from those to which we are now alluding, nor are we aware of any facts to prove that even in them Bright's disease has been developed in consequence of the transient departure from the normal. Lastly, it must be remembered that those indulging in athletic exercises of all kinds are presumably sound in heart as well as limb, and that such persons may take with impunity, and, indeed, with benefit, measures which would be distinctly harmful to the weakly.—*Lancet.*

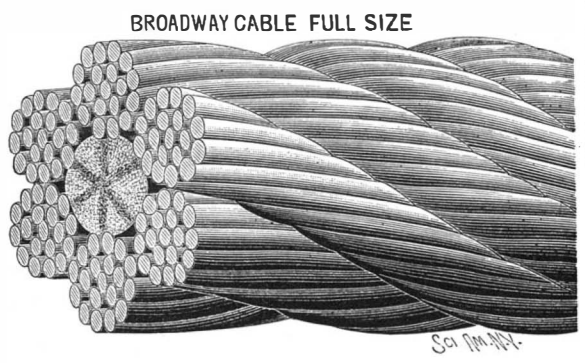
CABLE RAILWAY ACCIDENTS.

People who are habitual riders on electric and cable cars have a feeling of exemption from shocks and undue speed while riding on the cable cars that is not experienced while riding on the trolley cars, but the cable car system has shown itself capable of accidental derangements which are quite as able to work harm as anything that may happen to the electric car system.

Not long since one of the cable cars in lower Broadway, after a brief stop of the cable, started, and when an attempt was made by the gripman to stop the car, it was found impossible to release the grip, and the car moved down Broadway toward Bowling Green, clearing everything before it, having a propelling force behind of not far from 1,200 horse power, with no immediate prospect of being stopped. As the cable railway has no telegraph, the telephone was brought into use, and in due course of time communication was had with the engineer at the power house, and the cable was stopped. On examination of the grip it was found that a certain amount of slack in front of the car allowed of the formation of a loop, which,



A LOOP CATCHES THE CABLE GRIP.



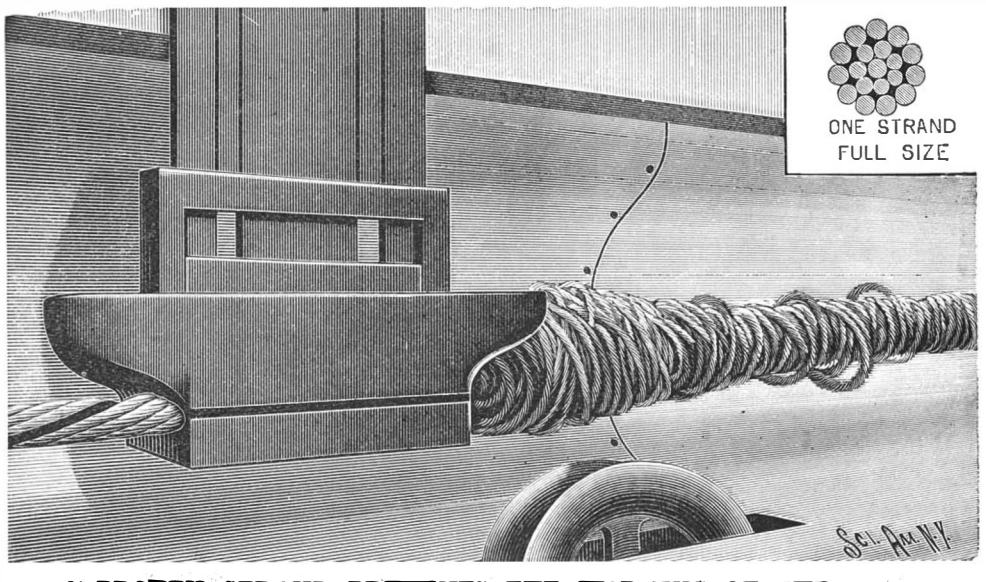
singularly enough, took the form of a hitch around the projecting horns of the grip, as shown in Fig. 1. The only way to release the grip from the cable in this case was to break the grip and remove it from the cable conduit, the car being towed back to the car house by coupling it with another car.

Although the cable is sufficiently flexible to permit of passing around the huge drums at the power station and over the guiding sheaves in the street, it was far too rigid to permit of releasing the grip by any manipulation of the cable itself. By viewing Fig. 2, which represents the cable full size, it will be seen that it is no easy matter to bend such an aggregation of steel wires, even though the cable has a flexible center of hemp. The cable is formed of six strands, the exterior layer of each strand consisting of eleven wires, Nos. 9 and 11 alternating, the inner layer being formed of seven No. 9 wires, while the center wire of the strand is also No. 9, making nineteen rigid steel wires in each strand.

This accident was mainly due to an unnecessary amount of slack in the cable—something which will be guarded against in the future, so that an accident of this character is not likely to happen again.

In Fig. 3 is illustrated an accident of a different character. In this accident the car behaved as in the other case, that is to say, it was carried along the track irresistibly and the gripman was unable to release the grip so as to stop the car. After the power house had been signaled and the engine stopped, an examination of the cable in the conduit showed that one of the strands of the cable had been broken, and the cable, in sliding through the grip, pushed back the strand until 1,500 feet of it had been piled up upon the cable, the strand thus shoved back upon the cable occupying a space of 200 feet behind the grip. This accident caused a delay of several hours. There was no remedy for the delay, as the spare cable had not been laid in the conduit. Traffic had to be suspended until the cable could be put in running condition, which was done by removing the loosened strand.

Although the cable is constantly and carefully inspected in its passage through the power house, it is obviously impossible to guard against an accident of this kind. The only safeguard lies in careful cable construction and in extreme care in making splices. It would also seem that the Cable Railway Company should provide some means of communication between all parts of the road and the power house, by means of which, in cases of accidents like these, the engineer may be notified and the engine instantly stopped. It is remarkable that neither of these accidents resulted in any serious casualties.



A BROKEN STRAND PREVENTS THE WORKING OF THE GRIP.

Congress of Anthropology.

Anything undertaken by men like Dr. D. G. Brinton and Prof. F. W. Putnam is reasonably sure of success. Hence much is anticipated from the series of meetings in the interest of anthropology to be held from August 28 to September 1 inclusive, in the Art Palace at the World's Fair in Chicago. The plan is to hold daily meetings at a convenient hour, after which the audience will adjourn to inspect whatever portion of the exhibit may best illustrate the papers just discussed. Monday will be devoted to considering anthropological laboratories; Tuesday to folk-lore; Wednesday to the Government building exhibit; Thursday to archæology; Friday to ethnology, and Saturday to foreign exhibits, especially as bearing on European archæology.

The general list of papers includes such topics as: The Anthropology of American School Children, by Dr. G. W. West; Aboriginal American Mechanics, by Otis T. Mason; Critical Study of Flaked Stone Implements, by W. H. Holmes; The Present Status of our Knowledge of American Languages, by Dr. D. G. Brinton; Orientation, by A. L. Lewis; The Ethnology of the Face, by S. H. Thompson; The Folk-lore of Precious Stones, by G. F. King; Folk-lore of the Ojibwas, by Dr. Robert Bell; Omaha Love Songs, by Miss Alice C. Fletcher; Zuni Ceremonials, by P. H. Cushing. Religious rites among the Jews, Egyptians, Hindoos, Indians, and other nations and tribes, will be treated by Dr. Cyrus Adler, Dr. J. G. Bey, Prof. M. Bloomfield, Dr. Franz Boaz, and others qualified to handle such subjects. Prof. M. Jastrow will discuss the historical study of religions as a feature of the college curriculum. Numerous other topics are announced, and the Congress of Anthropology promises to be an assembly of unusual interest and one that should attract public attention.

Corn Bread no go in Germany.

Notwithstanding the recent culinary efforts of a patriotic American to educate the German up to an appreciation of the savory and nutritious properties of Indian meal, Dr. Eugene Sell, of the Imperial Health Department, has reported to the Prussian government that this substance is not a wholesome article of diet, and is unsuited for general consumption. The *Medical Record* thinks if Dr. Sell could but examine some of our stalwart mountaineers in West Virginia and Kentucky, and see how they thrive on hog and hominy, he might be led to distrust the accuracy of his laboratory experiments.

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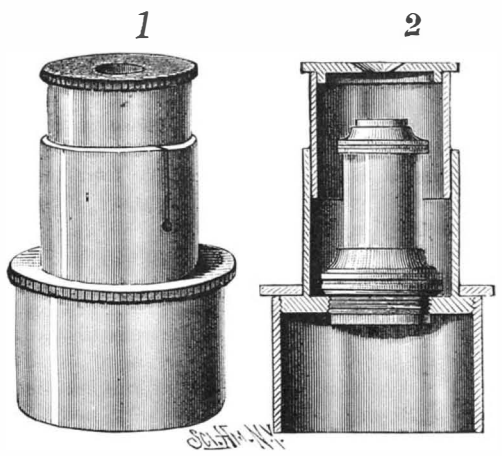
SUGGESTIONS IN OPTICS.

BY GEO. M. HOPKINS.

Every investigator, whether induced to examine into things for pleasure or profit, has at hand optical appliances capable of double use which would permit of greatly extending fields of investigation if such



OBJECTIVES USED AS EYE PIECES.

uses were to suggest themselves. To many the suggestions here given will not be entirely novel, while to others they may be new and may prove of considerable value.

Having a spy glass or small telescope, and desiring a microscope of low power, one has only to use the compound erecting eye piece of the spy glass. This suggestion has often proved of value to the writer during an outing. An eye lens of a field glass or opera glass has served as an amplifier for the microscope, and a hand magnifier has been used as a condenser. A microscopist short of eye pieces may press his objectives into the service by producing a mount like that shown in perspective in Fig. 1 and in longitudinal section in Fig. 2. This mount fits into the top of the microscope tube and is provided with a fillet having the society screw for receiving objectives large end down. In the upper and smaller end of the mount is inserted the cylindrical part of the perforated cap. The writer has used Bausch and Lomb objectives of the professional series, one-fifth, one-half, three-quarters, one inch and two inch for this purpose with good results. After having used the adapter with the objective in the manner described, the writer learned that Mr. John Phinn published a similar device some years since.

The value of an eye piece for focusing the image in the camera in certain kinds of work does not seem to be generally acknowledged. In this case the ground glass is removed and a positive eye piece is supported so that its focus and the focus of the photo lens coincide in the same plane. An easy way to arrange this is to insert a piece of plate glass in the place of the ground glass, and provide the eye piece with a foot resting on the plate glass, the eye piece being adjusted so that it will be focused on an image formed at the inner surface of the plate glass. The plate glass may be dispensed with if means are provided for supporting the eye piece so that it will unerringly focus at the focal plane of the camera, while at the same time it can be readily moved about into all parts of the field. This method of focusing is particularly advantageous in photo-micrography, when it is often difficult to see the image when it is received on a ground glass focusing screen. By the use of the eye piece, focusing is made simple.

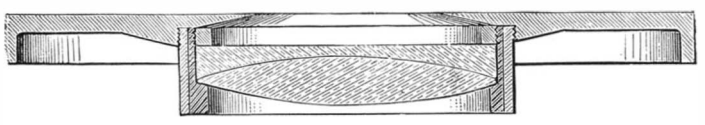


FIG. 5.—MICROSCOPE STAGE WITH TELESCOPE OBJECTIVE.

Many photographers have attempted to extemporize a telescope by using a part of the photographic combination as a telescope objective. This scheme has generally failed, as a part of the combination is not usually corrected for a perfect image when used with a full aperture. By using a complete photo lens of any first class make as a telescope objective, and employing in connection with it an eye piece of suitable power, a telescope is formed which is of some service.

This combination can be used in the camera box in the manner illustrated in Fig. 3, or the photo lens and eye piece may be fitted to opposite ends of an adjustable tube, telescope fashion. This will be found more convenient in use. With a good sized photo objective and eye piece of suitable power the observer will derive a great deal of satisfaction from star gazing, and when a compound erecting eye piece is borrowed, even from a small spy glass, the combination of the two forms a very useful terrestrial telescope.

There is no reason why a microscopist, especially if he is a naturalist, should not make use of the telescope in some of his investigations. Watching insects and the smaller animals at work is an interesting occupation which may be carried on by the aid of a small telescope, provided the objective be sufficiently perfect to permit the use of powerful eye pieces.

By combining a small telescope objective of fine quality with a microscope stand, the microscopist is enabled to use his eye pieces to good advantage, the whole forming a fine telescope of great power. Such an instrument might properly be called a long range microscope. Fig. 4 shows an instrument of this kind in use. In the stage of the microscope stand is secured a fine objective—of about eight inch focus—borrowed from an engineer's transit. The open space between the lower end of the microscope tube and the stage does not interfere with the operation of the instrument.

Focusing is done by means of the milled head of the microscope. In the instrument illustrated eye pieces from one and a half to one-quarter inch focus are used. At a distance of eight or ten feet the operations of insects may be observed under considerable magnification.

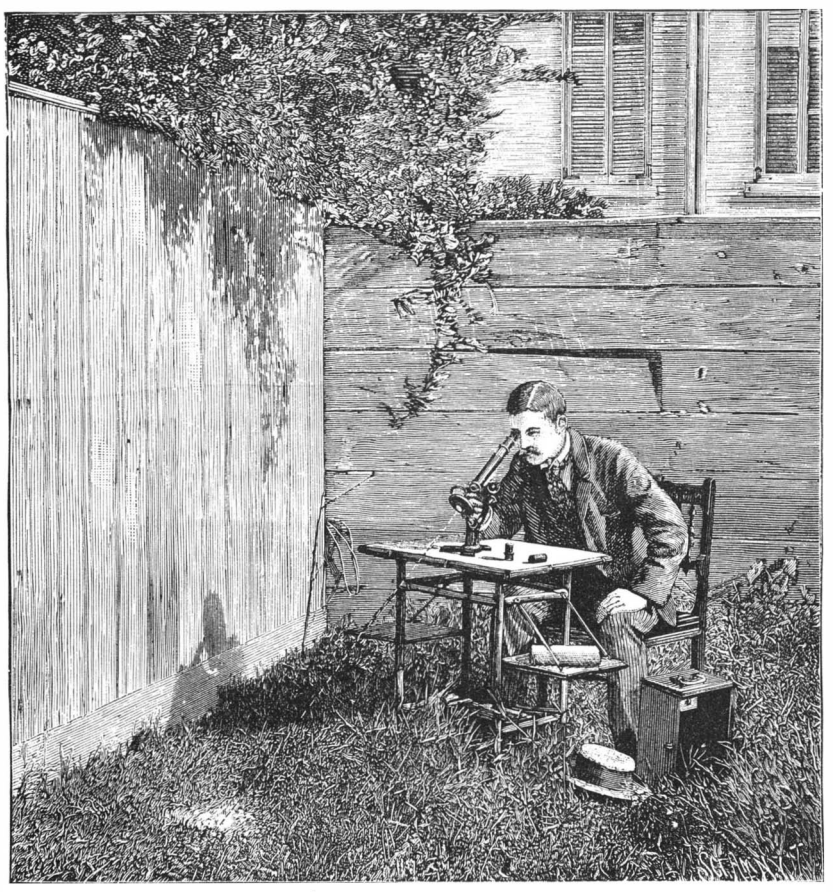


FIG. 4.—THE LONG RANGE MICROSCOPE.

Fig. 5 is a transverse section of the microscope stage, showing the position of the telescope objective.

Trades Union Folly.

Work on the new wing of the beautiful Mutual Life Insurance building, in New York City, has ceased. The building, which is to be fourteen stories high, has been carried up ten stories, and the electric wiring is going on in it. So far the wire men have cut holes for themselves, eight men being constantly employed in the building for that purpose. It seems, however, that some bricklayers, who were out of work, saw them, or heard of them, and appealed to their union to get the wire men out and themselves put in. A deputation of bricklayers accordingly waited upon the superintendent of the building and demanded that the work of cutting holes in the walls should be given to them. They informed the superintendent that if this modest request was not complied with, all the bricklayers in the building would strike. While the superintendent was considering the matter, the walking delegate of the Electric Wire Men's Union appeared on the scene, and gave notice that if bricklayers were employed to do the cutting, all the wire men in the building would strike. As the building could not go on without both kinds of workmen, the superintendent concluded to do nothing, but let the two unions settle the dispute for themselves; and the bricklayers in the building, forty-eight in number, accordingly dropped their tools and departed.

A New Process for Aluminum.

A dispatch from Duluth, August 22, says: "The Patent Office authorities sent to this city a chemical expert on an application for a patent for a new process of obtaining aluminum from its oxide. The process includes chemical combinations heretofore supposed to be impossible, and on this ground the application for a patent was rejected, the method being termed inoperative. Three entirely satisfactory tests were made by the government chemist, and he has returned to Washington. A copy of his report to the Patent Office was received here to-day. After detailing the tests as made by himself, he says that the process is operative, that it appers to be almost perfect in its results in obtaining the entire aluminum value of the oxide.

"The discoverer of this process and his Duluth associates say they can produce pure aluminum at a price considerably below that of any of the electrical processes, and cheaper, bulk for bulk, than copper. The native clay is useless. In fact, the only available mineral for the purpose is bauxite, which is an impure oxide of aluminum."

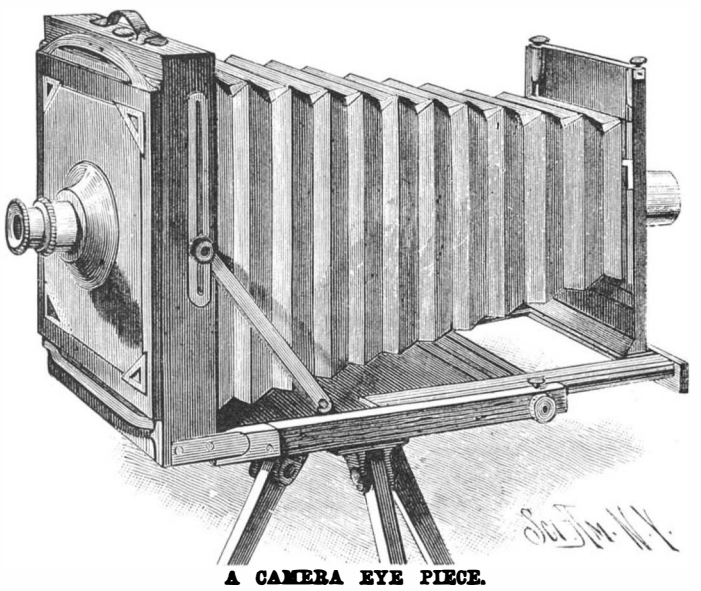
The Bruges Ship Canal.

Movements are being made for the commercial rehabilitation of the old town of Bruges in Belgium. Bruges was at one time the commercial center of Europe, or in other words the world. In the fifteenth century the "City of Bridges" attained the height of its prosperity and then gradually began a wonderful decline which reduced the capital city of West Flanders, the autocrat of commerce, to a third rate provincial town. Bruges enjoys an immortal celebrity in the history of art, for in the fine old city oil painting had its origin. Bruges was connected with the sea by canals which were blocked up by the Antwerpers until Bruges lost her prestige. The quaint old city is to be roused from its lethargy and restored once more to the world as a maritime mart. A ship canal will connect the now deserted canals with the sea.

The town has voted a subsidy of 2,000,000 francs to aid in the work. From an æsthetic point of view the canal will entail a loss, as it will be difficult to retain all the picturesque features of the quaint old Flemish city of which Longfellow sang so beautifully.

Military Ballooning in France.

Some experiments in military ballooning were lately made in Paris. Five balloons were sent up from the Esplanade des Invalides. The aeronauts in charge of them were instructed to descend within an hour as close as possible to Combs la Ville, after passing over a radius of twenty miles supposed to be occupied by an enemy. A number of cyclists were sent off with instructions to pursue and capture any of the five balloons that failed to cross the zone of investment. M. Jacques Courty, in the balloon Patriote, carried off the palm. He alighted within a mile of the church of Combs la Ville. The balloon directed by M. Picq touched the ground only a couple of hundred yards further from the town, while M. Compiegne alighted from a third balloon at Reaux. The other two balloons fell within the radius, and were captured by the cyclists.



A CAMERA EYE PIECE.

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THE GREAT GERMAN SEARCH LIGHTS AT THE WORLD'S COLUMBIAN EXPOSITION.

Among the exhibits at the World's Columbian Exposition which are prominent in the evening are to be found the search light projectors, whose far-reaching arms of light tip different objects of interest in the grounds, with occasional flashes upon vessels, buildings and other prominent objects many miles distant, illuminating them with all the splendor of sunlight, thus exhibiting in times of peace one of the most valuable implements of modern warfare.

Prominent among large search lights at the Fair may be seen the exhibit of Schuckert & Co., of Nuremberg, comprising four of these monster search lights, placed on the four corners of the middle roof of the Manufactures building at a height of 240 feet above the ground. Owing to the failure of the electric department of the Fair to furnish cables and current, only two of these lights are at present in operation. Our illustration shows one of them as it appears high above the Exposition grounds, the Wooded Island in the foreground, Horticultural Hall in the middle distance and the Ferris Wheel and buildings of the Midway Plaisance further away. By comparison of the search light and the figure, a good idea of the size of the projecting apparatus may be obtained. The top of the apparatus stands 8½ feet above the platform and the diameter of the projector is 5 feet. The mirror, which is of silvered glass, has a clear working diameter of 5 feet, with a thickness of about ⅞ of an inch. It is carefully ground and polished on both sides, the labor requiring over five months for its completion. The back of the mirror is provided with a heavy coat of silver, protected by a specially prepared paint. The training of the projector can be effected either by hand or by means of the electric motor placed under its base. When the electric motor is used, it can be operated from any distance. The large projectors are intended especially for coast defense, and the apparatus for controlling the projectors must necessarily be near the commander.

It is said that the light from this projector can under favorable conditions be seen from Milwaukee, 85 miles distant, and a person standing eight miles away can read a newspaper illuminated by the light of the projector. A person standing at the side of the projector can, by the aid of a good field glass, distinguish the vessels of an enemy twenty miles away.

Our second engraving shows the search light beam projected on the Ferris Wheel, and it is said by those who have seen it that although the Ferris Wheel is dark in color, under this illumination it appears at a distance as if it were painted a glistening white.

The peculiarity of this projector, aside from employing a parabolic mirror, consists in using an arc light having the carbons parallel with the axis of the projector, the positive carbon lying outermost, with the crater in the direction of the mirror.

The lamp used in the projector requires a current of 150 amperes at 50 volts, and consumes about 10 electrical H. P. The surface intensity of the light in this mirror is 194,000,000 candle power. The ends of the carbons are shown full size in Fig. 3, and in Fig. 4 the relation of the arc, F, to the mirror, A, is shown. The carbons may be adjusted to project either a convergent or a divergent beam, moving them inward toward the mirror producing the divergent beam, and moving them in the opposite direction producing the convergent beam. The average intensity of the rays received by the mirror is 45,600 candle power, and the mirror takes up a beam having an angle of 140°. This angle includes the most intense rays, which lie between 40° and 60° from the normal.

The various points here given in relation to this interesting exhibit were furnished by Mr. Fred W. Tischendoerfer, representative of Schuckert & Co. at the Chicago Exposition.

Our artist correspondent describes his adventures in witnessing the practical working of one of these great lights as follows: "In order to make my sketches it was necessary to do some climbing, owing to the new rule of not allowing the elevators to be run. I called around one evening about the time Mr. Tischendoefer's assistant goes up, to show me the way. Going up two flights of stairs, walking a short distance through the gallery, we came to the foot of a ladder forty-two feet in height. He started up, I followed close behind; at the top we crawled through a scuttle, walked along the eaves of the gallery roof about 200 feet, where we came to a second ladder, which was about fifty-five feet high. We climbed this, coming to the third ladder, which was about 125 feet. I have read of Jack and his bean vine, it may be a nice story, but this was reality, as I climbed away, not daring to look behind me, one step after another, at last reaching the top of the long ladder. The last ladder to climb was ten feet in height, bringing me on the cornice of the building, two hundred and forty feet from the ground.

"The effect down below was beautiful. Thousands of electric lights glittering. The electric fountains throwing up purple, red, yellow and green streams of water, which added to the scene. A storm was coming up in the distance, and I must say I felt lonesome upon that roof, a thousand feet in length. But I had come to see the search light and was very anxious to see it and get down as soon as possible. When the switch was thrown, the beam of light shot forth and the scene was more dreamy than ever. Gnats, flies, and thousands of vermin flying through the rays looked like bright pieces of metal. The power of the light being so great, when it was thrown on the Ferris Wheel, about two miles distant, the structure appeared to be like white enamel, although it is a dark object, the outline of which was very sharp and clear. Smaller details were distinctly seen. When the beam was thrown on a white object close by, the effect was surprising. It was like the focus of a sunglass, and seemed as if the object must smoke in a few seconds. Swinging the light on the battleship Illinois, it appeared brighter then when seen in full sunshine. The electric launches and gondolas looked like toothpicks floating around in the lagoons. People walking along the avenues looked about the size of small tacks. As it commenced to sprinkle, the light was shut off and covered up, and then the journey down commenced, with steady step by step, until I reached the ground in safety. It was a rare experience."

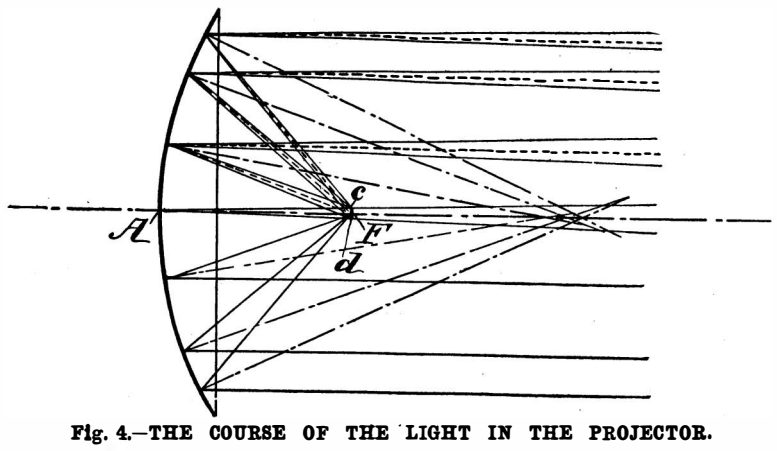

Fig. 4.—THE COURSE OF THE LIGHT IN THE PROJECTOR.

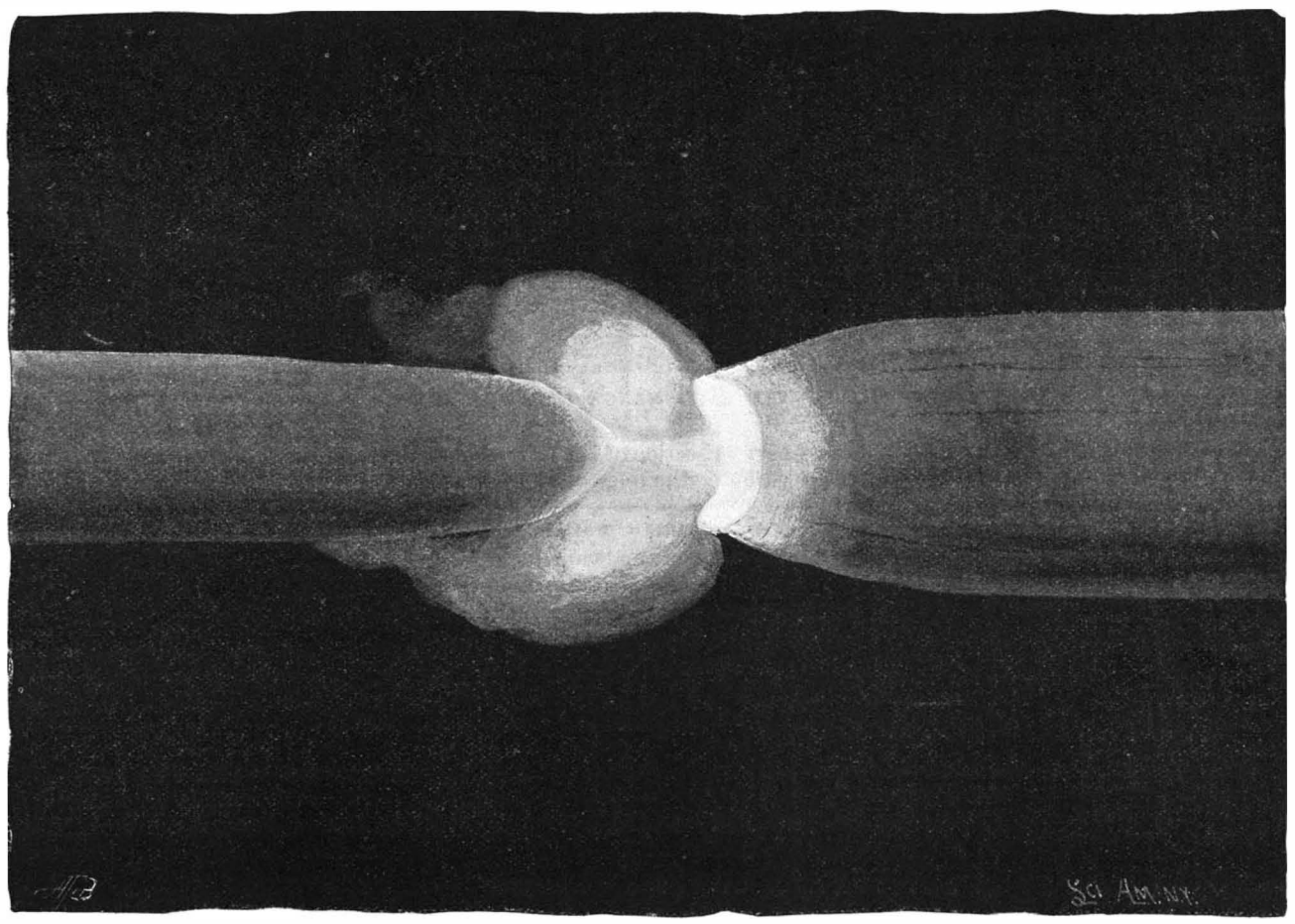

Fig. 3.—CARBONS OF THE GREAT GERMAN SEARCH LIGHT, FULL SIZE, SHOWING ARC AND FLAME.

Homemade Celluloid.

The following formula makes a substance as transparent as pure glass at the same time very pliable and strong: Dissolve four to eight parts of gun cotton in a mixture of alcohol and ether, in proportion of 1 of gun cotton to 100 of the combined liquid, after which add 2 to 10 per cent of castor oil, or any other oil unsiccative, and 4 to 10 per cent of Canada balsam. Flow this mixture on to a glass plate, and dry in a current of air at 50°. The result is a leaf of hard substance as transparent as glass, and very nearly unbreakable, resisting perfectly the action of all salts, acids, and alkalies.

Lysol, a New Antiseptic.

Lysol, says Dr. Eric Vondergoltz, of New York, is obtained by dissolving in fat and saponifying with the aid of alcohol the fraction of tar oil which boils between 190° and 200° C. It is a brown, oily-looking, clear liquid, with a feebly creosote-like odor. It contains 50 per cent of cresols. It forms clear mixtures at once, in every proportion and at all temperatures, with water. It possesses the properties of a saponaceous solution in addition to its germicidal power. While as valuable as bichloride of mercury, it is without any toxic property—a point to be considered when it is used in cavities, and especially in gynecology and obstetrics. In the latter, and especially in emergency cases, lysol is of the highest value.

The Holy (Cholera) Well at Mecca.

Mr. E. Frankland, writing to the London *Times*, on the condition of the water of the holy well of Zem-Zem, used by the Mahometan pilgrims at Mecca, says: A sample of the water came to me through the India Office. It was full of dead microbes and contained, in an equal volume, considerably more animal matter than is found in average London sewage. In addition, it afforded evidence of previous pollution with an amount of such matter at least six times as great as that contained in an equal volume of average London sewage. The water has been again, quite recently, analyzed by Colonel Bonkowski Bey, consulting chemist to his Majesty the Sultan of Turkey. His results confirm my own analysis. They show that the water is still abominably polluted by excrementitious matters. The surroundings of this well are such as would be likely to impart to the water these dangerous ingredients. Mecca appears to have no sewerage system; all foul matters being buried in the earth within or near the city. Hence the foulness of the water percolating into the well through this mass of corruption. Colonel Bonkowski Bey informs me that Mecca is supplied with water of excellent quality; but, of course, the pilgrims are bound to drink at the holy well. Tens of thousands of pilgrims continue to die of cholera at Mecca and to spread the disease elsewhere; but, so far as I know, no measures have been taken to prevent pollution, and Mecca continues to be a cholera center.

PONTOON bridges, with copper pontoons, were invented by the French about 1672.

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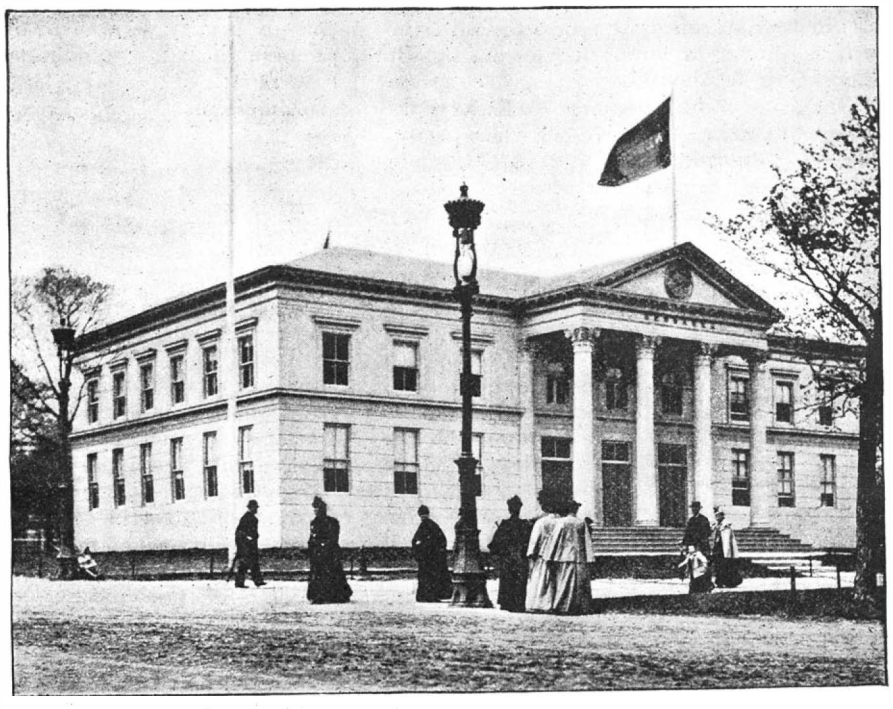
THE WORLD'S COLUMBIAN EXPOSITION—STATE BUILDINGS.

The Indiana State building is in the French Gothic chateaux style, and its appearance is a credit to the Exposition, the architect, and the State of Indiana. It is the design of Henry Ives Cobb, the architect of the beautiful Fisheries building. Cost, $60,000. The building measures 53 by 152 feet. The first story is Indiana graystone, the second and third stories are of wood covered with staff. The towers are 150 feet high. The floors of the lower story are covered with mosaic, and the doors and other woodwork are in oak. Parlors and waiting rooms take up the ground floor. The upper floors are devoted to offices, exhibition rooms, etc.

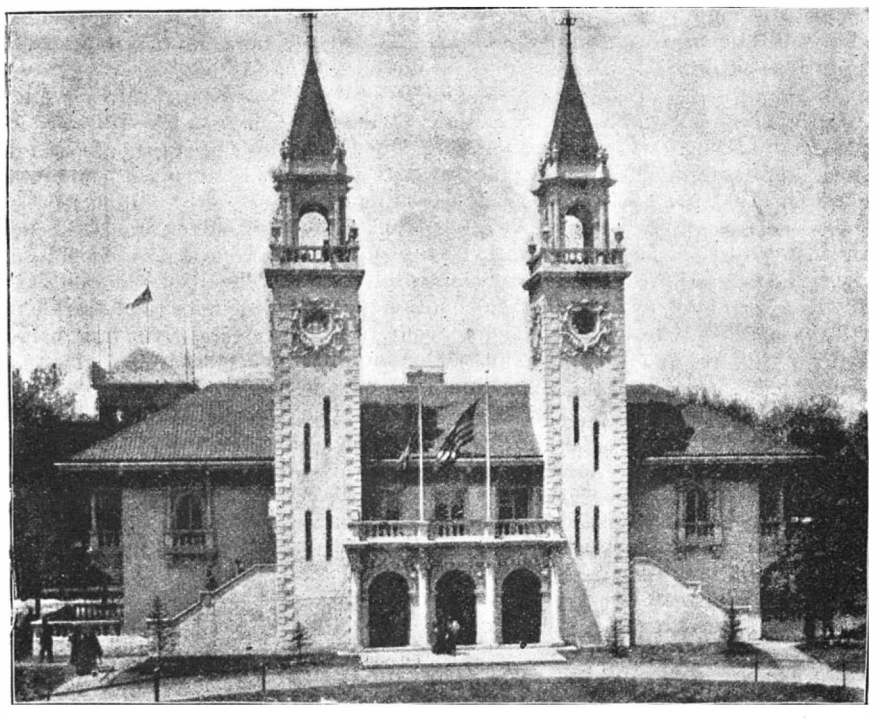
The Maine State building is an octagonal building with a ground area of 65 feet square. The architect was Mr. Charles S. Frost, and the cost $20,000. The building is two stories high; the first story is of granite from various quarries in Maine. The roof exhibits the slate of the Monson quarries. The interior consists of an octagonal rotunda two stories high, around which are grouped offices, exhibition rooms, etc.

The Nebraska State building is built in the colonial modification of the classical style. The building, which was designed by Henry Voss, of Omaha, measures 60 by 100 feet, cost $15,000, and is very pleasing in appearance. A large portico, the ceiling of which is supported by eight large columns, gives admission to the interior, which contains offices, retiring rooms, parlors, etc., as well as considerable space for exhibits.

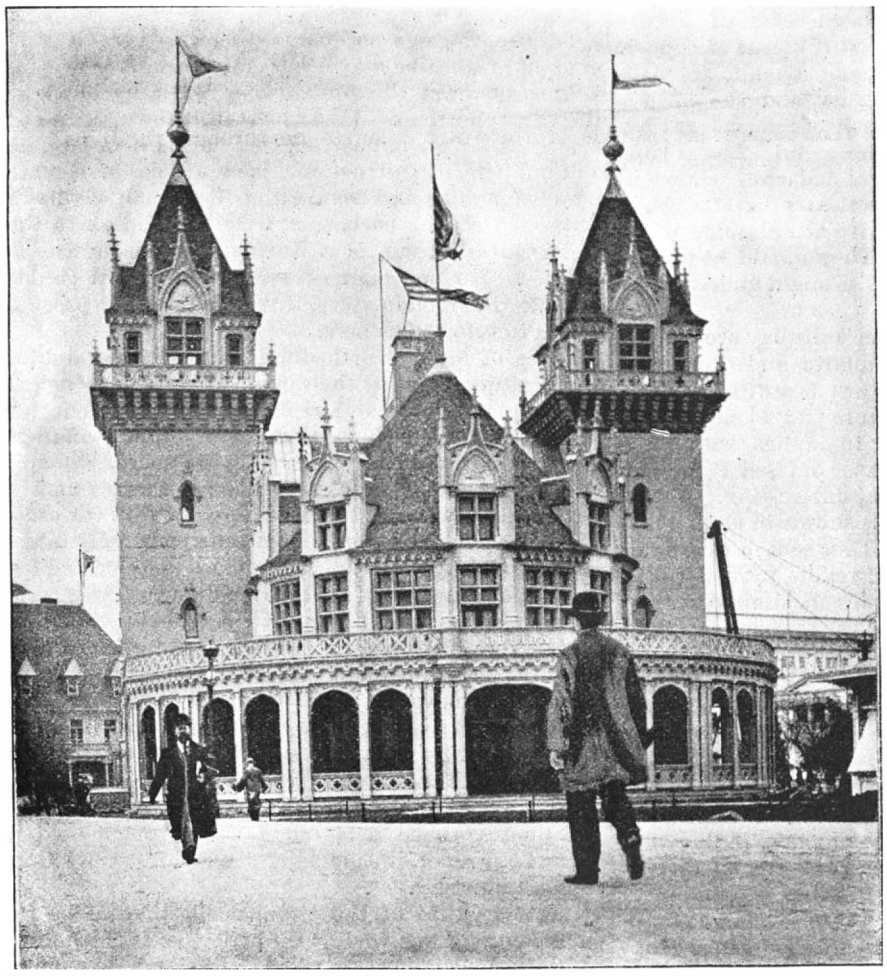
The building of Colorado, the "Centennial State," was designed by Mr. H. T. E. Wendell, of Denver. The architectural style is that of the Spanish Renaissance. The building is very pleasing and successful, from an architectural point of view. The color of the building is an ivory white, and its two stairways outside the building add to the picturesque effect. The twin towers are 80 feet high, while the peaked roof rises from a cornice which is 26 feet from the ground. The building measures 45 by 125 feet, and the entrance is 40 feet wide and 26 feet deep. Balconies abound, and the whole building suggests pleasant lounging. The usual reading rooms, parlors, etc., are provided. The interior fittings are rich and in good taste.



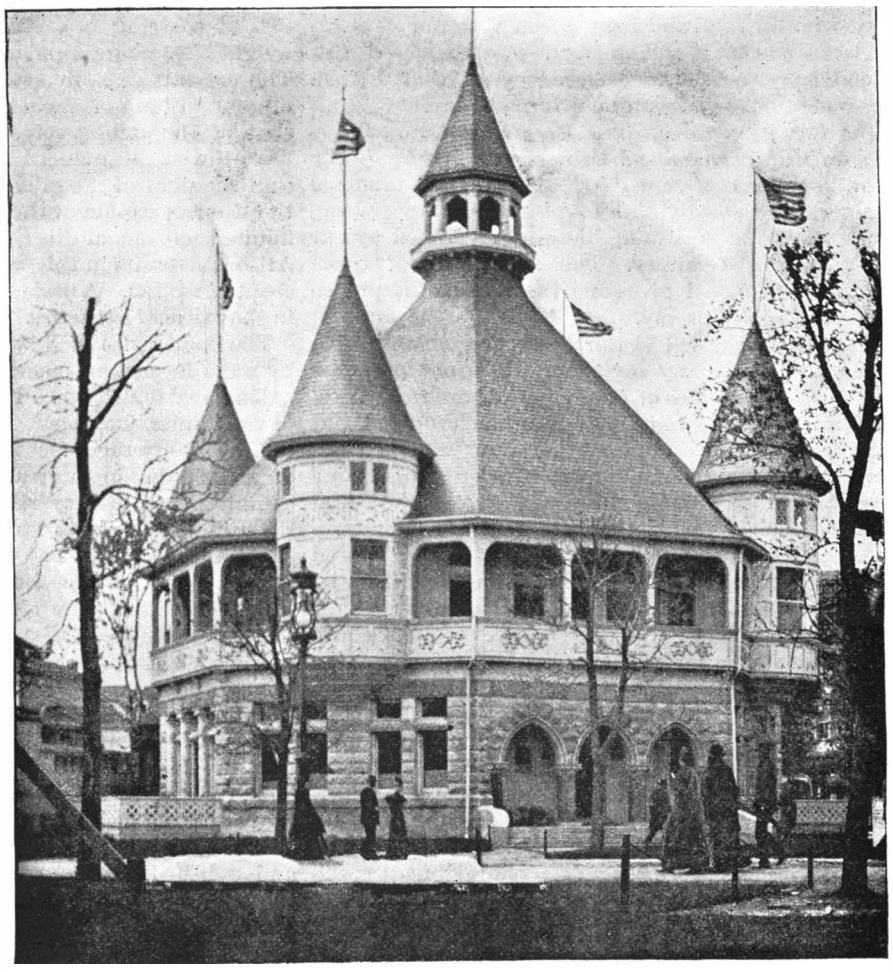
THE NEBRASKA STATE BUILDING.



THE COLORADO STATE BUILDING.



THE INDIANA STATE BUILDING.



THE MAINE STATE BUILDING.

THE WORLD'S COLUMBIAN EXPOSITION—STATE BUILDINGS.

High Railway Speeds.

One of our English contemporaries says that "it is stated that speeds of 80 miles, 90 miles and finally 112·5 miles an hour have been attained on American railways. It may be taken for granted that these statements have foundation in fact." Probably our contemporary would be astonished to know that a speed of 90 miles an hour is reached every day for very short distances on one railroad in the United States, and this with trains of four, five and six cars. We have not inspected the performance sheets, but we are assured on excellent authority that such is the case. The probable weight of one of these six-car trains is about 270 tons. Our contemporary then goes on to consider the "bursting effort" of an engine going around curves, and calculates that at 100 miles an hour this "bursting effort" on a curve of 660 feet radius would be a little more than equal to the weight of the train. "Thus, with a 65 ton engine this bursting effort would be 65 tons. Hence, it approaches perilously near to what would suffice to overturn an engine bodily." The writer concludes that "while speeds of 100 miles an hour may be regularly attained on railways, we not only believe, but know, that they can only be reached with safety on tracks especially constructed for the purpose." We hasten to assure the editor that these prodigious speeds are not made on curves in this country; but we call the attention of Mr. Buchanan, Mr. Ely, Mr. Paxson, Mr. Vauclain and other reckless Yankees to the note of warning which the English editor has sounded.—*Railroad Gazette.*

Boat Sunk by a Shark.

A remarkable drowning accident happened in the Bay of Fundy, off Green Point, Digby County, August 7. An Indian, accompanied by a boy, was paddling in a birch bark canoe when a large shark bit the bottom out of the canoe and it filled with water. The Indian sank and was drowned. His body was afterward recovered. The boy was saved.

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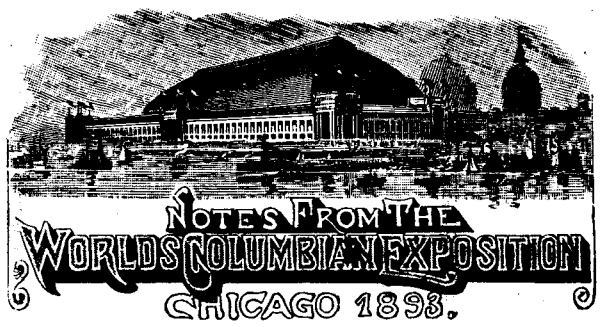

The beautiful white buildings of the Exposition are to be sold as junk. They are soon to be advertised and knocked down to the highest bidder. About the only things of future use in them are the iron and steel arches and timbers. It is thought that not more than $1,000,000 can be realized from the auction. The most expensive buildings will probably bring the least money. The Manufactures and Liberal Arts building, which $1,600,000, and which has $500,000 in arches alone, will of necessity, it is believed, be given to the man who will tear it down and carry the material away. The magnitude of the undertaking will be realized when it is stated that each arch contains twenty car loads of steel, all the pieces being firmly riveted together. The salvage in the Administration building will also be very small. The Mines building, on the contrary, is regarded as a more favorable prospect. The steel arches are much lighter than those of almost any other building on the ground, and could be taken down and set up again for a large workshop or factory. They would also be available for a depot of moderate size.

Two hundred and ninety-one West Point cadets arrived in Chicago August 18. They encamped on the plaza between the Government building and the Illinois, the brick battleship. The United States Military Academy band accompanied the party.

Aug. 19 was dedicated to Britain's glory, and loyal sons and daughters of the empire flocked to Victoria House to see the Union Jack floating from the top, and to Festival Hall to hear "Rule Britannia," "God Save the Queen," and other selections fitted to the occasion, as well as enthusiastic speeches full of loyalty to England and good Queen Victoria. The attendance was large, and when the evening closed with splendid fireworks it was agreed by all that British day was fully as successful as German day.

The Rocky Mountain and Pacific States and Territories in the Palace of Mines and Mining.—The most depressed pessimist in these days of financial disaster could hardly fail to be cheered by visiting the sections of the Mining building occupied by our most Western Territory. The abundance of treasure there displayed gives one the sense of a practically exhaustless supply.

For the untraveled visitor from the Atlantic seaboard, there are many surprises. He is not prepared to see large quantities of crude petroleum from Wyoming and from Colorado, not only the crude oil, but naphtha, paraffine and the other light oils. He has supposed that the Lake Superior region and Arizona were our chief sources of copper, but in the Montana section he reads that "in 1892 Montana produced more copper than all the rest of the United States together." Utah has not been famous for its coal, but the Territory has a great display, showing, indeed, much of the history of its production and the results of its distillation in the specimens of albertite, uintahite, asphaltane, lignite, natural coke and coal of various degrees of bitumenization. New Almaden has been known as the source of our mercury, but Utah has this, too, in abundance, alloyed with gold, and in the realgar and cinnabar ores.

While there is much similarity in the exhibits of all this group of States and Territories, I have studied them with reference to noting the characteristic specimens in each, and of these chiefly I write.

Utah's section is large and crowded, but not well arranged. Much space is given to a black, highly lustrous substance resembling albertite and labeled "Gilsonite, from Fort Duchesne." I have never been fortunate enough to find any one in charge of the section, and men in those adjoining are as ignorant as your correspondent about this mysterious-looking substance. But the quantities of stibnite, sulphur and copper ores tell their own story. In unguarded cases are rubies and onyx of great value. Salt is shown in massive cubes. Matrix alum in large quantities, asbestos and mica are conspicuous

Montana's display is among the most showy. People who have no interest in her minerals look with wide-eyed admiration at the graceful figure of Justice. I am told that Ada Rehan was the model for the statue, which was cast in Chicago of Montana silver. It stands on an appropriate pedestal near the center of the section. But the display of silver in its unworked condition is, to some eyes, even more beautiful; the native crystals are wonderful in their perfection, and the quantity in strings is surprising. The fine crystals of quartz incrusted with rhodochrosite, of baryta, calcite and selenite are most satisfying to the mineralogist. One prominent case contains a magnificent display of gold in grains and nuggets; sapphires, rare and beautiful for size and luster, are under the same glass, and yet the most conspicuous display in this section is that of copper in immense sheets and long bars. They are sent by the Parrot Silver and Copper Company, whose mines and reduction works are at Butte City.

Colorado's coal exhibit is most interesting. It is shown in all the forms, from lignite, bituminous, semi-bituminous, up to anthracite, whose analysis shows: Carbon, 89·45 per cent; hydrogen, 3·33 per cent; oxygen, 1·19 per cent; and sulphur (only), 0·78 per cent.

Here is powdered silica as white and apparently as well suited to the glassmaker's use as that from the Massachusetts deposits. Gypsum in its natural state and reduced to plaster of Paris is shown in large quantities. From what is supposed to be the only source in the United States, the Cheyenne Mountains, have been brought quantities of cryolite, whose analysis is given as: Aluminum, 13 per cent; fluorine, 54·50 per cent; sodium, 32·50 per cent. There is a wealth of lead, silver, iron, and copper ore. Zinc is shown in the various stages of smelting.

The display of gold is especially interesting, because it includes the telluride petzite and a large number of crystals of the native metal. Some are arranged under magnifying glasses. The right of this State to much space is told in the following figures, which show that between 1876 and 1893 Colorado mines have added to the wealth of the world:

Silver	$278,106,525
Gold	63,943,263
Lead	63,068,000
Coal	49,734,726
Copper	4,163,040

The display made by Arizona is not so wide in its range as that of the States mentioned; but for beauty it is unsurpassed. The specimens of petrified wood from Apache County are not finer than those Tiffany has, but the great fragments of trunks reassure one about the vast extent of the forest changed into this gorgeous mass of color, which no artist can approach in mosaic. There are very interesting crystals, red and yellow, of sulphur and arsenic, formed in the process of roasting ore. One cubical mass of azurite weighs 5,695 pounds and assays 35 per cent of copper. The crystals of both azurite and malachite are magnificent. Many of them are drusy, and the effect is that of the richest velvet. Such specimens are too beautiful to be reduced for the metal. Let us hope that the sight of the table tops of malachite shown in the Russian section of the Liberal Arts building may induce some one in this country to utilize some of the Arizona deposits in this way. They should be cut instead of melted. A philanthropist might undertake it, in the cause of æsthetics.

The boundaries of New Mexico's display are defined by walls formed of masses of quartz and ore pyrite, galena, malachite, etc. There are beautiful crystals of vanadinite, fluor spar, aragonite and selenite; some of the last are three feet long. Idaho has sent a piece of rock containing a great number of fossil fish. Her exhibit of ore is very rich and interesting. Native silver in quartz and in strings is shown in large quantities, and argentite assaying 80 per cent of silver. Of the lead ores, the specimens of yellow pyromorphite, cerusite and galena are remarkable for size and beauty. Mineral water in bottles occupies a prominent place in the section, and suggests the locality of the Saratoga of the future.

Wyoming shows great masses of coal and rich gold, iron, lead, copper and tin ores; of the sulphates, gypsum in fine crystals and magnesium and sodium in large masses suggest exhaustless quantities to be had for the taking. Of building materials, red sandstone is exhibited. Among the many minerals, both rough and polished, in this collection, none are so rare as the blue and white moss agates. One is tempted to linger long in this section, for the clear, large photographs of the Yellowstone Park are so arranged that he feels he is actually among the geysers and other wonders of the strange, wild region. The photographs in the other sections of which I have spoken are hardly less interesting; some of them show the color of the rocks, all of them give such an impression of grandeur that the lover of scenery is tempted almost as much as the would-be finder of a fortune to risk his all in actually getting a view *in situ* of all these mountain marvels.

Of the Pacific States, Washington makes a brave display of iron, silver and gold ore heaped in pyramids. Among the gold nuggets from Kittitas County is one valued at $500. A unique exhibit in this section is that of colored sands arranged in glass jars. There are eleven shades, ranging from pure white through grays, yellows, etc., to garnet. What a paradise for future glass and porcelain makers! This State shares with Colorado in being a source of molybdenum.

California's display of gold and silver is not significantly larger than that of her neighbors on the east and north. The effort of her exhibitors seems rather to have been to show her other treasures, of which the world has heard less, and they are truly bewildering in quantity, variety and loveliness.

Such skill in transmutation as the alchemist never dreamed of, nature has shown in that marvelous place. Out of masses of carbonate of lime have been cut thin pieces varying in size from a few square inches to two or three square feet. The pictures are polished, and arranged on easels like transparencies; they show cloud and mountain effects in pale greens and yellows; the touch of gray in the white gives all the appearance of a haze in the atmosphere. These exquisite pictures are sold under the name of onyx, at hundreds of dollars apiece. They are far more delicate and beautiful than the marble called Mexican onyx. A slab of moss agate measuring four feet by four vies with the marble in beauty. Cinnabar is shown from the Bradford mine in Lake County, so rich that the product for the month of January, 1893, was 760 flasks of mercury. Aluminum is obtained from a clay whose analysis shows:

Aluminum	42·97 per cent.
Silica	12·54 "
Oxide of iron	0·63 "
Alkalies	4·70 "
Water	0·39 "

Among the iron ores are found magnetite, limonite, chromic and bog ore. Among the copper, the red oxide and the green carbonate. Stibnite is there with ingots of antimony beside it, and specimens of pyrolusite found in paying quantities. Salt is displayed in both translucent and opaque cubes. Borax and asbestos swell the list. Nothing is more noticeable than the masses, large and small, of rubellite. There is a profusion of it from San Diego County. One must see the radiate crystals of red tourmaline set in the lilac lepidolite to know the exquisite beauty of this mineral. A case of rocks of the State shows many representatives of both metamorphic and igneous—basalt, graphic granite, gneiss, diabase, trachyte, diorite, porphyry, porphyritic syenite, etc. Possibly, it is in the study of these California rocks, where almost every known metal is hidden, that geologist and mineralogist alike are to find the answer to some of their most puzzling problems.

The Columbian Exposition.

To the average mechanic there is here a vast amount of what he may deem unimportant to the inventor, or even the ordinary mechanic, as he views the vast collections. Yet as he studies the articles and machines, so numerous and vast in their variety, he will not tire of instruction. New articles of use are here before him, and from all civilized, half civilized, down to the real barbarian, from the flint ax to the wonderful dynamo, is a vastness of inconceivable wonder. No one man or woman of natural genius can afford to remain away, if they can possibly procure means to bring them here.

Those of foreign birth who have made this land for any considerable time their home will find here erected facsimile buildings and relics of those in their far native land, from that of massive public buildings down to the humble dwellings like the poor Irishman's thatched roof, to the famous Blarney Castle; and to an American who has traveled abroad out of curiosity these remarkable resemblances are exceedingly interesting. Chicago is remarkably fitted and located for this wonderful exhibit, being located on the great lake. Naval and marine exhibits are shown to great advantage. Here is everything in this line, from the war ship and beautiful yacht to the crudest dugout from Canada's backwoods, which brought its remarkable adventurer in his patched-up craft over one thousand miles, and really a beggar, to see the marvelous wonder of the world.*

I got a sight at Brousseau's log canoe, self, and dog. It is photographed here, but I failed to get hold of one. Your reporter should get one and illustrate it in the SUPPLEMENT.

One never tires of the strange collections of the far off regions. I was to-day through the India house, where wooden images of worship and ingenious carving and the very finest fabrications are collected. To the inventor, the mechanic, the mineralogist, the chemist, the fabricator, the designer, the learned and the unlearned, here is your school that will never be seen again in this generation.

J. E. EMERSON.

* The man's name is Antoine Brousseau. Although unable to read or write, he heard of the Fair and made up his mind to visit it. He found an old leaky punt about 15 feet long which had been abandoned, patched it up, and decided to use it as his means of transportation. With the aid of favorable winds, a horse blanket, and an old wooden paddle, he succeeded in reaching Chicago after traveling a distance of something like 1,000 miles. His only companion was his dog Pete. Before he left his northern home he had never seen a railroad or an electric light; had never heard a band of music or the whistle of a steamboat. At one of the points on his way a band of music was playing, and there also he first gazed upon the wonders of electricity. He was so carried away with what he saw and heard that he thought he had reached heaven. The region whence Brousseau comes is as wild to-day as it was when Chicago was only a trading post, the temporary stopping place of men like himself. He says that he has lived in the woods for months at a time without seeing a human face. He was born and raised in the wilderness, and until he started on this wonderful voyage of his he was ignorant of the conditions of life in the great world beyond the "clearings."

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THE NEW U. S. S. DETROIT.

This cruiser is the latest addition to the navy, and is an exponent of the class of so-called protected cruisers, which rely solely upon coal and a very minute subdivision of the compartments in the region of and below the load line for protection against serious injury. This is further secured by cofferdams worked in the vicinity of the machinery spaces to prevent the water, in case of injury, from finding its way to the larger compartments in the center of the vessel.

All the machinery, dynamos, and magazines are placed beneath a watertight deck of thin plating, which at its outboard ends is some three feet beneath the water line, but rises considerably above it in the central portions. The object of this deck is, not to afford resistance to a shot from an enemy, but to allow the side of vessel to be pierced near the load line, or even below it, without flooding the compartments containing the boilers, engines, and magazines. The dimensions are as follows:

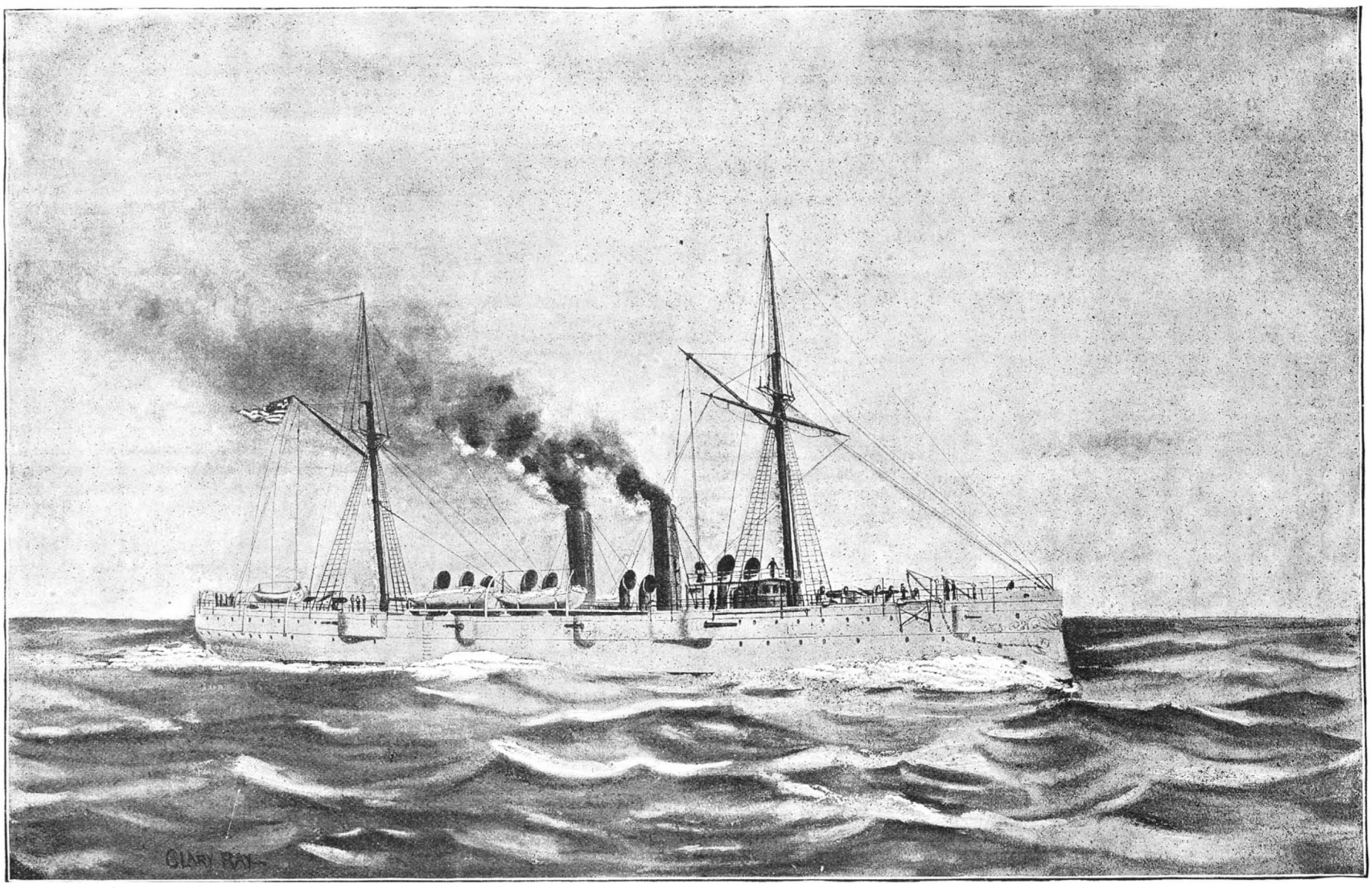
Length on load line	257	feet.
Beam, extreme	37	"
Draught, mean	14½	"
Displacement	2,050	tons.

The battery carried is eight 5 inch R. F., two 6 inch breech-loading rifles, six 6 pounder Hotchkiss guns, two 1 pounder, two Gatlings, and five tubes for launching automobile torpedoes. The 6 inch guns are mounted in the open on the poop and forecastle deck, and protected by flying shields of light armor. The 5 inch guns are mounted in an open waist, and beneath the poop and forecastle, as shown in accompanying picture, the machine guns are so disposed as to command all points of approach to the vessel. The machinery was designed to develop 5,400 I. H. P., and the estimated speed with this power was 18 knots per hour; but under the stimulus of a bonus of $25,000 offered by the government for each quarter of a knot in excess of the speed contracted for, the builders succeeded in making a speed of 18·7 knots with a developed power of 6,000 horses, thus netting them the handsome bonus of $150,000.

The Montgomery is a sister ship, and the builders have great hopes on her trial of exceeeding the performance of the Detroit. This class of vessels is among the most useful we possess in times of peace, on account of the small cost of keeping them in a high state of efficiency, and that, owing to their light draught, they are able to enter all ports of any importance, representing our country and protecting its commercial interests.

As naval vessels are necessarily the homes of the officers and men for cruises of at least three years, the matter of comfort in the accommodations and improvements that tend to make the vessel more habitable and healthful are of more importance that at first view we, who at most are accustomed to trips across the ocean, are disposed to give them; therefore, in the Detroit, we find the quarters commodious, heated by steam, ventilated by huge fans near the center of the vessel, which draw the heated and vitiated air from the living spaces and discharge it overboard, allowing fresh and pure air to find its way in through the hatches and air ports. The vessel is also lighted in all parts by incandescent electric lights, and provided with powerful steam pumps which can in a necessity, at a moment's notice, draw water from any portion that may be injured.

The contract was made with the Columbian Iron Works and Dry Dock Company, of Baltimore, Md., for the building of the hull and machinery at a cost of $612,500. The vessel is now in commission, under the command of Captain Brownson.



THE NEW PROTECTED CRUISER DETROIT.

Chloride Accumulator Plates.

The plates of the Electrical Storage Battery Company, of Philadelphia, are made, so says *Electricity*, as follows:

The chloride accumulator plates are manufactured in the following manner: Chloride of lead and chloride of zinc mixed in the proper proportions are cast into rectangular tablets, which may then be subjected to such treatment as will withdraw the chloride of zinc and at the same time decompose the chloride of lead, and thus convert the tablets into plates suitable for use in storage batteries without any further mechanical treatment.

It is customary, however, to first incase the tablets in a frame of metal, which serves to hold them rigidly and protect them from injury in handling. This is accomplished by placing the tablets of chloride of lead and chloride of zinc in a suitable mould and pouring in a melted alloy of lead and antimony, which flows around the tablets, forming a frame in which they are firmly and permanently fixed.

The above constructed plates of chloride of lead and chloride of zinc are not capable of use in a storage battery. They are not capable of serving as oxygen plates, as they will not absorb oxygen.

They are not capable of use as hydrogen plates, as not only would their immersion in the dilute sulphuric acid of a storage battery cell result in contaminating the fluid with chloride of zinc, which would be fatal to its proper action as a storage battery fluid, but the effect of hydrogen liberated would, if any action took place, be to form hydrochloric acid with the chlorine of the chloride of lead, which hydrochloric acid would further contaminate the fluid and make it inoperative as a storage battery fluid; moreover, these tablets are non-conductors of electricity.

It is evident, therefore, that the plate of tablets consisting of chloride of lead and chloride of zinc is worthless in its present condition as a storage battery plate, and cannot be used as such. Its chemical composition must first be radically changed in order to fit it for service in a storage battery either as an oxygen or as a hydrogen plate. This chemical change is brought about by means of a bath of chloride of zinc or some equivalent substance in which the plate of tablets is to be immersed in connection with a slab of metallic zinc. This arrangement is in fact a primary battery in which the zinc acts as the positive element, while the tablets constitute the negative element.

The chemical action in this combination results in withdrawing the chloride of zinc from the tablets by simple solution in the bath, and the withdrawal of the chlorine of the chloride of lead from the tablets and the fixing it in combination with the zinc with the formation of chloride of zinc.

The chloride tablets in the plates are not in any sense active material, nor are they material capable of becoming active in a secondary battery fluid.

They only constitute material which may be subsequently rendered active by the electrical disintegration which is brought about when they are connected with the zinc plates in the bath of chloride of zinc. When the process of electrical disintegration is complete and we have washed all the chloride of zinc out of the plate, we have a mass of metallic lead which is suitable for immediate use in a storage battery without the tedious forming process of Plante, and without the application of any active material or material about to become active by the processes of Brush or Faure.

Phytoline for Obesity.

An excessive amount of fat, says Dr. I. N. Love, M.D., of St. Louis, is not only unsightly, but is unhealthy; in fact, as an evidence favoring the thought that fat is a low grade tissue, we speak of other tissues degenerating into fat. Certainly, the tendency toward the accumulation of an extra, unnecessary amount of fat favors a dangerous fatty degeneration of the heart and the tissues forming other important organs. The proper selection of diet, with exercise, can do much toward the diminishment of fat; but the profession and the laity have long looked for some remedy which could be depended upon to assist toward the consummation devoutly to be wished. In phytoline we have such a remedy. It is prepared from the active principle of the berries of the Phytolacca decandra after having been touched by the early frost.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

TRAIN STOPPING DEVICE. — John B. Gross, Hoboken, N. J. A moving train is, by means of this device, designed to be stopped automatically when moving into proximity of an open switch, draw or other point of danger, the steam being shut off and the air brakes applied to bring the train to a standstill. The mechanism comprises principally a valve connected with the train pipe for applying the brakes and means for supporting the valve directly from the axle of the locomotive or tender, in connection with a valve-operating lever adapted to be actuated by a track mechanism. The same inventor has obtained a further patent on a train stopping device, relating principally to the track mechanism necessary in the operation of the foregoing improvement. The invention consists essentially of a signal arm, which swings over the roadbed, and is journaled in a bracket erected on the ties, there being also supported on the bracket a mechanism connected with the shaft of the arm and with the switch or draw.

CAR JOURNAL LUBRICATOR.—Sampson Walker, Winnipeg, Canada. A hanger suspended from the box has a horizontal member extending beneath the journal, on which turns and slides a loose roller pressing against the lower face of the journal. The roller has on its face a layer of cotton wicking and turns in oil, with which the lower portion of the box is filled. The construction is such that the device cannot be accidentally displaced, while it can be quickly and accurately adjusted to apply the oil evenly to the journal and does not require any kind of packing.

Electrical.

ELECTRIC SWITCH. — Joseph H. McEvoy, Waterbury, Conn. This invention provides a peculiar construction and arrangement of rotary contacts with positive actuating mechanism and an escapement or intermittent stop mechanism for conveniently and quickly turning on or cutting off any number of electric lamps, motors, heating apparatus, telephone or telegraph instruments, etc. It is also adapted to the use of cutting off all circuits leading into a building in case of fire and can be connected through electro-magnets which operate the shifting lever by wires running to thermostats at different points, so as to be automatically operated in case of fire or a great rise in temperature.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.—Wilton F. Jenkins, Richmond, Va. The main feed wire, insulated throughout its main portion, is firmly secured alongside the outer side of the rail by a special form of clamp, and at intervals of six or eight feet is a bared, looped portion, adapted for engagement by the brush or contact piece upon the car, a removable cap fitting on the extremity of the contact portion to receive the frictional wear of the brush. The latter is formed to extend between two of the feed wire contacts, so as to be always in touch with one of them, a wire leading from the brush to the motor on the car.

GAS ENGINE ELECTRIC IGNITER. — Frank E. Tremper, New York City. Permanently separated rigid electrodes are, according to this invention, insulated in the cylinder, the electrodes being formed with sharp-edged heads at their inner ends inside the cylinder, while a flexible sparking strip is held insulated on the reciprocating piston and adapted to make contact with the heads of the electrodes. The device is designed to ignite the charge in the cylinder always at the proper time, a premature explosion or failure of ignition being positively prevented, while at the same time the construction is simple and durable.

Mining, Etc.

ORE SEPARATOR.—Charles F. Willsie, Ogden, Utah Territory. A blast fan is connected with one end of a casing, at one end of which is a hopper, and a series of connected pans containing quicksilver is arranged on the bottom of the casing, agitating wheels being mounted to revolve in the pans, above which is a series of hinged gates. The improvement is more especially designed for dry placer mining, to conveniently and quickly separate the precious metals from the sand without the use of water. Electricity is applied to the plates and pans to electrically charge and give life to the quicksilver and keep it from flouring, and lamp heat applied under the pans, or other means, to facilitate the separating of the precious metal from the sand.

Mechanical.

TOOL FASTENING. — Robert Douglas, Fall River, Mass. This invention provides means of securing files and other tools to wooden handles. The tapering shank of the tool carries on its end a hard metal collar, and the shank, with its collar, is adapted to be driven into a previously made recess in the handle, the collar fitting very snugly at the inner portion of the recess, and the outer end of the recess being engaged by a portion of the tapering shank, whereby the tool is firmly held in place and prevented from turning.

WEAVING ELASTIC FABRICS.—Samuel Brown, Easthampton, Mass. This invention provides a method of weaving an elastic fabric, on one face of which is a frill woven integral with the body. The warp for the body is formed in two sections, arranged one alongside the other, and the warp for the frill is similarly arranged, there being two distinct sets of harness for the main fabric and two sets for the frill or ornamental part. Only a single shuttle is employed in weaving the entire fabric, the shuttle passing alternately over corresponding sections and under the other sections, so as to carry the weft thread alternately over and under alternating sections of the warps for both the body and the frill.

PICKER PROTECTOR.—John Johnson, Chester, Pa. This is a simple and durable device adapted to properly protect the picker against breaking, and designed more particularly for use on picker staffs formerly patented by the same inventor. Connected with the picker stick of a loom is a spring device adapted to counteract the movement of the stick in one direction and return it, the device being formed of two portions and a stop, whereby one portion of the spring is relieved of further strain before the end of the movement of the picker stick, and the remaining portion is subjected to a suddenly increasing tension to check the movement of the picker stick and prevent breakage of the picker.

BELTING.—Karl Kuchler, Aussig, Austria-Hungary. This is a woven belting formed of wire and fibrous material interwoven to present the wire to one face and the fibrous material to the other face of the belt, the fibrous material being carried over to form the selvedge of the belt, and a protective border being secured to the outer face of the edges. This belting is designed to be very inexpensive, pliable, with the minimum of "stretch," and the quality of "hugging the pulley."

SAW TEMPLET.—Benjamin F. Spooner, Orange, Texas. To afford improved facilities for examining and marking saws, to correct faults in the saw blade by means of the usual hammering process, is the object of this invention, which provides a stock or holder in which is adjustably held a flexible band, with means for adjusting to the desired curve.

MACHINE FOR FORMING SPIRAL WIRE SPRINGS.—William B. Jackson, Portland, Oregon. This invention relates to springs used for making bed mattresses, upholstering and other purposes. To illustrate and explain the various details and combinations of parts embraced in the improvement has required a patent which has seven sheets of drawings and twelve printed pages of specifications and claims. The machine is arranged to automatically coil the wire into a double spiral and to fasten the ends of the wire upon the end coils.

Agricultural.

POTATO DIGGER. — Hamilton Pray, Clove, N. Y. Attached to the rear of a plow of any approved construction is one or more chain drags, some of the links carrying prongs arranged in a novel manner, constituting an operating agitator or whirl as the chain is drawn along. The whirl also has the tendency to throw the potatoes farther out to the sides of the furrow, keeping them on the surface of the ground and preventing their being covered up by the loose rolling earth.

LAND PULVERIZER. — Benjamin S. Sexson, Cincinnati, Ind. The main frame of this machine, with its drive wheels and axle, supports and operates a vertically swinging frame carrying rotary cutters or pulverizers adapted to be held at any necessary height and to turn easily through and pulverize the soil. Several of the pulverizers are provided to adapt the machine to different varieties of soil and to obviate replowing on any soil which has been once plowed, and the construction of the pulverizers is such that they may be cheaply made and easily repaired.

CONVEYER BELT FOR HARVESTERS.—Delos W. Storms, Western, Neb. This belt has diagonally located slats of greater thickness at their grain ends than at any other point of their length, the slats being constructed of a leather body and having a capping or covering of sheet metal. The construction is designed to obviate any falling out of the grain and insure its delivery to the elevator or the various packers of the binder straight, or in such manner as to insure its proper binding.

Miscellaneous.

SAFE.—Frank Crawford, North Urbana, N. Y. The door of this safe is made so that alarm will be sounded in case it is attempted to drill into it, or so that a cartridge may be exploded to kill or seriously injure the one operating the drill. Means are also provided whereby, when the safe door is locked, a cartridge will be automatically presented to a hammer, the cartridge being removed out of the path of the hammer when the door is opened in a proper manner. The alarm mechanism is so inclosed within the door as not to be visible.

PACKAGE ENVELOPE.—Martin Hess, New York City. This is an envelope to be attached to packages and to contain a bill or messages to go with the package. It has scallop-like projections along its margin to receive a cementing compound, so that it may be readily applied to a package, and a line of perforations, to permit the ready removal of the envelope, which remains sealed after it is detached.

LADDER.—Russell D. Hetrick, William T. Wilson, and Edward Rowe, Indiana, Pa. This is a step ladder in which continuous braces of bent wood engage the steps and the sides, the brace extending from side to side of the ladder, which is very strong and light. It also has a back support with rungs, whereby the ladder may be used by two persons, and the parts are readily separable to form two ladders when desired.

WRINGER ROLLER.—Otto W. Walscheid, Jersey City, N. J. The rubber roller of a wringer has, according to this invention, a bearing sleeve held within it and adapted to turn loosely on the wringer shaft, end nuts screwed into the sleeve being provided with flanges to abut with the ends of the rollers. This construction is designed to overcome the friction strain by the slipping on the shaft of the strain-bearing sleeve of the roller.

BRICK PROTECTOR.—Nils Olson, Superior, Wis. This is an improvement on a formerly patented invention, providing sheds or protectors with folding wings or roofs, that the yard may always be kept dry and work proceeded with in rainy weather. Gutters are arranged to carry away the water shed by the wings or roofs, and means for covering the alleys between groups of protectors, the wings being raised separately or simultaneously as desired.

BOTTLE FILLING APPARATUS.—John Jackson, Lonsdale, R. I. This is an improvement on a former patented invention of the same inventor, providing means whereby a number of bottles may be simultaneously filled without spilling, whether transparent or not, there being separate filling tube of correct size for each bottle, and there being connected with the source of supply reservoirs adapted to hold a predetermined quantity, with means for cutting off the connection while the bottles are being filled and turning it on after they are filled.

SCULL PROPELLER.—George O. Adams, Firth, Neb. Two sets of sculling blades are jointed to independent hubs at the rear of the boat and arranged to revolve in opposite directions, with their axes above the level of the water, the blades being arranged to open or expand and descend partly into the water, or to close up partly out of contact with the water. Great effectiveness in propelling may thus be obtained, the boat being steered by rotating only one blade.

ANIMAL TRAP.—Joseph Nelson, Nauvoo, Ill. Sliding between vertical guides of a suitable frame is a weight adapted to be suspended by a bail connected with a pivoted locking arm, the bait being so held that the stepping of the animal upon a tripping platform beneath will free the weight to drop on the animal. The trap is cheap and simple, easily sprung, and especially designed for catching small animals, as rats, mice, squirrels, etc.

Designs.

DRESS TRIMMING.—Julius Dreyfuss, New York City. This design consists of cord figures at each side of a central band figure, the figures appearing connected at each side by transverse cord figures arranged with return effect, a band figure appearing between the groups.

CUT GLASS DISHES.—Daniel Forbes, Brooklyn, N. Y. The designs of two dishes have been patented by this inventor. One design consists in a star formed of two intersecting equilateral triangles forming a hexagonal central field ornamented by a rosette, the apexes and exterior angles of the star being also ornamented by rosettes. The other design consists in a five-sided figure having each apex connected by two curved and crossing lines. From each apex also leads a curved line, these lines forming five-sided spaces ornamented by rosettes.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

AUGUST, 1893.—(No. 94.)

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1. Elegant plate in colors, showing the villa erected for J. Armoy Knox, at Primrose Park, Mount Vernon, N. Y., at a cost of $14,928 complete. Floor plans and two perspective elevations. An excellent design.
2. Plate in colors showing the colonial residence of L. Allyn Wight, at Montclair, N. J., erected at a cost of $15,400 complete. Perspective view and floor plans. Messrs. McKim, Mead & White, architects, New York. An attractive design.
3. A cottage erected at Portland, Me. Perspective view and floor plans. A model design. Cost $3,400 complete. Mr. J. C. Stevens, architect, Portland, Me.
4. A Queen Anne cottage, erected at Wayne, Pa., at a cost of $6,000 complete. Floor plans, perspective view, etc. Messrs. F. L. & W. L. Price, architects, Philadelphia, Pa. An excellent design.
5. Engraving and floor plans of a dwelling recently erected for A. B. Root, Esq., at Springfield, Mass., at a cost of $2,500 complete.
6. Engraving and ground plan of Grace Episcopal Church, at Plainfield, N. J., erected at a cost of $40,000, complete. Mr. R. W. Gibson, New York City, architect.
7. A dwelling recently completed at Brookline Hills, Mass., at a cost of $5,120, complete. Perspective elevation and floor plans.
8. A cottage at Elm Station, Pa., erected at a cost of $3,900, complete. Floor plans and perspective.
9. Wood and stone dwelling at Narberth, Pa. A unique design. Perspective elevation and floor plans. Estimated cost $5,000, complete.
10. Design for a village library.
11. The Fifth Avenue Theater, New York. View of the family circle and of the handsome drop curtain. Mr. Francis H. Kimball, architect, New York.
12. A suggestion in corner decoration. Bay window decorations.
13. Miscellaneous contents: Wiring of buildings for electric lights.—Montauk club house, Brooklyn, N. Y.—A novel system of domestic water supply, illustrated.—Wood mantels and ornamental fireplaces, illustrated.—Fencing made of sheet metal, illustrated.—The Hartman sliding blind; view of factories.— An improved dimension saw, illustrated.—Plumbers' and steamfitters' supplies.—The Capitol hot water heater, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(5300) Z. B. writes: During the last summer, on the afternoon of a day in August, a large barn was burned here by lightning. The cloud passed over unattended by rain, and the occurrence was most sudden and terrifying. Workmen engaged in the open field in the vicinity, affirm they saw no lightning—a circumstance probably not unusual in similar cases. But they affirm, moreover, that the stroke upon the building was heard in advance of hearing the sound of the thunder. Could this be the fact? A. We see no inconsistency in the occurrence. The thunder may have been produced at a point remote from the barn.

(5301) A. A. F. T. asks: Have any people, apart from the native bushmen of Australia, ever acquired the art of throwing the boomerang successfully? As made by them, is the flat side of the weapon worked to a perfect plane? A. The Australians have brought the boomerang to its highest perfection. Other savage races have used them, but not of anything like the qualities of the Australian weapon. The flat side is not necessarily a perfect plane.

(5302) C. H. A. asks: 1. In making motor of same dimensions as in SUPPLEMENT, No. 641, except the field having but two coils wound on U-shaped core, same placed in upright position, what size and quantity of wire should be used? A. Use in the two coils the same amount of wire as is used in the four coils of the double magnet. 2. What difference would such motor have in speed and power to No. 641? A. There will be practically no difference. 3. Have you published an article on such motor? If so what issue? A. No.

(5303) P. B. P. sends sketch of an insect.—Answer by Professor Riley: The sketch is apparently intended to represent one of the "walking sticks" and probably the "thick-thighed walking stick" (*Diapheromera femorata*). I may be mistaken, as the sketch is crude, and only an examination of the specimen itself will enable a perfectly accurate naming. If it should prove to be the species mentioned, it is one of the most curious insects in our fauna, although not a rare one. It feeds upon the foliage of oak, hickory, and other forest trees. A long account of the life-history of the species will be found in my report as entomologist, Annual Report Department of Agriculture, 1878, pages 241-245.

(5304) A. G. L. asks: How should cut flowers be packed for mailing that will be four or five days in transit? A. In tin boxes, with a sheet of cloth well dampened with water.

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(5305) T. K. writes: I observe very frequent reference in the SCIENTIFIC AMERICAN to the Fuller battery. I have tried, without success, to get information about this battery or to obtain the cells or parts of them here, as it seems to be quite unknown. I should therefore feel greatly obliged for a working description such as would enable an average amateur to construct the battery. I wish it for use with a bedroom glow lamp of about 6 volts. I use at present 3 cells plunge chromic acid battery, but the lowering and raising of the plates is troublesome, as the battery is only used occasionally for a minute or two at a time. How long does the zinc generally last? Is it free from local action when the circuit is open? Is chromic acid, bichromate] of potash, or chromate of soda best for such batteries? A. We advise you to use the plunge battery, as the Fuller will not stand an open circuit. It is described in our SUPPLEMENT, No. 159. The zinc would last a long time, except that the solutions would mi xand local action would occur. Chromic acid or sodium chromate are preferred to the potassium salt.

(5306) W. W. P. writes: I have a double sulphate of nickel bath (about 20 gallons) which worked with perfection until lately. It now turns dark, and it seems to turn only in spots. I think the bath is strong enough, as it weighs 8½. The nickel scales where the black streaks occur. Please give me some receipt for taking foreign matter out of the solution. Could I overcome the difficulty by evaporating all the water and make a new bath with the nickel? A. By adding with constant stirring a saturated solution of ammonium sulphate to your bath, you can precipitate the double nickel-ammonium salt, leaving the supernatant liquid colorless. From the precipitate make up a new bath. (Unwin.)

(5307) F. P. writes: I would like to make some bottled soda water and I think I can do it by filling the bottle with water, putting in the proper amount of sodium bicarbonate, and lastly some citric acid in in crystals and corking it quickly before the acid can dissolve enough to act on the soda. What proportion of water, soda, and acid is best to use? Is there any way or material that would be better or cheaper that I could use without some special apparatus or tools? A. You require for three parts of citric acid, about four parts of sodium bicarbonate. For a pint bottle use two drachms citric acid and two and one-half drachms sodium bicarbonate. You may use the same quantity of tartaric acid iustead of citric. There is no better way of doing without special apparatus.

(5308) "Beta" says: How many quart size Fuller cells would be required to operate an induction coil giving ⅛ inch sparks, and about how many hours would they give a stream of sparks continuously on one charge of cells? An average estimate only required. A. Four to six cells should answer. They would run it many days before exhaustion, but owing to the mixing of the solutions, it would gradually become polarized.

(5309) C. C. W. writes: Many remedies have been offered in your columns from time to time for the relief or cure of poisoning by oak or ivy, and all probably have merit. I have found however that a solution of boracic acid, applied frequently, as soon as the symptoms make their appearance, will do wonders, in nearly every case completely breaking up the threatened inflammation. If the trouble has made much progress, the effect of the solution is still very much better than any other preparation that I have ever seen used, rapidly reducing the pain and inflammation. It seems to be fairly entitled to the name of specific. A saturated solution of the acid in hot water should be made, and that diluted with from one-third to one-half volume of water for use.

(5310) M. A. T. says: 1. Near our city is a gas (natural) pipe line thirteen miles in length. The first three miles are laid with six inch pipe, the remaining ten miles with eight inch pipe. The pressure at wells is 100 lb., at entrance to city it is about 25 lb. The line is laid over a hilly country. Do you think it possible to use an air compressor that will give a uniform pressure of 75 lb. at the city? If possible, how large a one and how much power will it take to drive it with? A. The laying of a new line of eight inch pipe, or even ten inch pipe, will be the most economical way of increasing the pressure at the end of the line. We cannot assign a definite size or cost of a compressor plant without knowing the present flow and proposed increase from pumping, which will require a compressor and boiler plant large enough to handle the total output of the gas well, and although the differential pressure head would not be very great, say 50 pounds per square inch, the volume would require the operation of a very large compressor—possibly from $6,000 to $8,000 would cover the cost of the plant, and require from 150 to 200 horse power.

(5311) X. Y. Z., Melbourne, asks: Is it practicable to drive a small boat—large enough to carry two persons—say ten or twelve feet long by about two feet beam, a speed of five or six miles per hour by hand power screw? According to my calculation, a ten inch screw, with pretty open pitch and 200 revolutions per minute, would do. Am I near it? Otherwise which would be the handiest and best power for a small boat like that? Could it be driven by an electric battery? If so, what about cost of such battery? Boat to be used on narrow and crowded river and occasionally on open bay —Hoboons Bay—in fine weather. A. Although two m n are power nough for a speed as stated in so small a boat, there are mechanical difficulties in its application that will modify its possibilities. A ten inch screw at 200 revolutions with a pitch of thirty inches, of which there can be realized not more than two feet of speed per revolution—a little less than five miles per hour, or with 250 revolutions per minute, will give a speed of nearly six miles. The necessary gear fortransmitting the power from the hands to the screw will somewhat diminish the result in speed. The boat is too small for successful application of electric or other power.

(5312) J. T. D. asks: How can we make a pond hold water where the banks and bottom are almost clear sand where we wish to make the pond? The soil is about eighteen inches deep, then comes sand, and to get the depth we want will have to go nearly two feet in sand. A. If clay can be had in the neighborhood or within a reasonable distance, the pond can be made tight with a clay and sand puddle, which, if two parts clay to one part of the sand from the excavation is used, should be fairly tight if made six inches thick all over the bottom and sides, well compacted by ramming, then covering with six inches of the fine top loam. If required for gathering ice, it should have a top dressing of coarse sand or gravel to prevent the water from becoming muddy by wind agitation. If no clay can be had, hydraulic cement should be used in the place of the clay, and which may be mixed with the sand dry by raking into the bottom and sides and wetting by sprinkling, then a top dressing of loam and gravel as before.

(5313) T. H. writes: Can you give the point of lowest elevation on the dividing ridge between Lake Erie and Ohio valley—from Chautauqua Lake to Toledo? If you have not the data at hand, perhaps some of your readers have. Where shall I hunt to find the difference in the levels of Lake Ontario and Hudson Bay? There is water running out of Chautauqua Lake at all seasons, more, apparently, in a dry season than enters on the surface. Where is this water supposed to come from? A. The lowest point on the Ohio divide is probably along the line of the Wabash Canal. The Secretary of State, at Columbus, can refer you to authorities on the elevation. Lake Ontario is 234 feet above the level of the sea. Hudson Bay is supposed to be at sea level. There is no reliable survey across the highlands of Canada between Lake Ontario and Hudson Bay. Chautauqua Lake lies in a watershed of gravelly soil, through which the water percolates to the lake in springs beneath its surface.

(5314) P. R. L. writes: It is stated in "Experimental Science" that an induction coil may be used in charging a Leyden jar. I do not understand how a condenser may be charged by an alternating current. Please explain the process and principle. A. To charge a Leyden jar or battery, by means of an induction coil, connect the outer coating of the jar with one pole of the coil and the inner coating with the other pole, making the connection through a pair of pointed discharge rods having their points separated to such a distance as will permit only the direct current—that of opening—to pass. This current, which is of higher potential, is alone used for charging.

(5315) O. S. asks: 1. Will you give me directions how to mend rubber, so that it will hold warm water? A. The only way to mend rubber so that it will withstand hot water is to apply a patch consisting of a layer of vulcanized rubber, then vulcanizing the whole. 2. Which is the best for field magnets of motor 767, cast iron or malleable iron, the armature being soft annealed malleable iron? A. Use soft gray cast iron. 3. How many layers wire would you wind on the fields, and how close should the armature run to the fields? A. Wind magnet wire on the field magnet until the depth of the winding is equal to the depth of the winding on the magnet core. The armature should always remain as near the field magnets as possible, without touching.

(5316) J. S. F. asks: Has the United States passed a law and fixed a penalty for mutilating foreign coins? A. There is no law against the use or abuse of foreign coins in the United States.

(5317) J. B. R. asks: Is there always a draught up a tall chimney, and does this draught vary at times very much? If there are times when no draught at all is felt, please give conditions. If there is always a draught up a chimney, as some authorities say (even though fire is not present), why is this not perpetual motion, and, if the chimney is large enough and sufficient chimneys were built together, could not power be produced? A. The draught of cold chimneys up or down depends entirely upon a small difference of temperature between the outside and inside, or the effect of the wind blowing across the top, which generally produces an updraught. Its power is very feeble, and cannot be considered perpetual motion, because it is due to natural causes.

(5318) J. W. S. writes: Do you think there is anything in the very common notion among practical mechanics that pumps raising water to a considerable height must be down close to the water to do their best work? I have changed a deep well pump from near the water to 26 feet up from the water without any apparent loss, and it seems to me that if the piston is sufficiently tight to raise the water up to the reservoir from the piston, that the water must follow up to the limit of atmospheric pressure for elevation, at which the pump is placed; however, the contrary opinion is widespread, and I would be much obliged for your judgment in the matter. A. The general opinion in regard to the position of pumps above the water surface for best work is founded upon long experience with all kinds of pumps, good, bad and indifferent. A perfect pump will work well up to 30 feet, with the only drawback of liberating air constantly from the water. With the least air leak below the pump valves, the efficiency is lessened, although not perceptible to the eye. The best principle is the best practice in setting a pump chamber, viz., close to the water.

(5319) T. D. D. writes: I have been a steady subscriber for your valuable paper for over 45 years, and wish you would make careful answer to the following questions: What would, in your best judgment, be the per cent. of saving to the track and roadbed and rolling stock of any through line of railroad if an endless rail could be used? If 90 foot rails were used, allowing the weight of three cars at once, or an engine and two cars, would not the rails be less liable to creep when there was no open space or joint, thus avoiding the pounding of the wheels at the ends of the rails? A. Continuous rails would be a most valuable consideration in railway economy and the comfort of the traveling public, but there is a physical bar to a continuous rail; the expansion and contraction of such a rail by changes of temperature would destroy the track. To make any computation of the saving of such rail in the face of its impossibility, would be futile. A 90 foot rail is a more reasonable condition, but will not avoid variation in length by changes in temperature, and consequent creeping. It would, no doubt, save two-thirds of the damage due to pounding and batterment of the rail ends. On the other hand, the difficulties of transportation of 90 foot rails is a serious bar to their use.

NEW BOOKS AND PUBLICATIONS.

SHORTHAND INSTRUCTION AND PRACTICE. By Julius Ensign Rockwell. Bureau of Education, Circular of Information, No. 1. 1893. 8vo. Pp. 205, tables.

The shorthand alphabets which date from the year 1602 on, are very interesting. The bulk of the work is taken up with statistics of instruction in shorthand in various institutions for the scholastic year ending June 30, 1890.

A CHAPTER ON CHOLERA FOR LAY READERS: HISTORY, SYMPTOMS, PREVENTION, AND TREATMENT OF THE DISEASE. By Walter Vought, Ph.B., M.D., Medical Director and Physician in Charge of the Fire Island Quarantine Station, Port of New York. Illustrated with colored plates and wood engravings. Philadelphia: The F. A. Davis Co. 1893. 12mo. 110 pages. Price 75 cents.

This timely little work is offered to the public in the hope that it will enable the reader to obtain a clear and comprehensive idea of a disease which at present, there is every reason to believe, will appear this summer in our own country. The diagnosis of the disease, its treatment and its prev ntion are all described with a view to being read by laymen. The preventive doctrines are based on common sense, and, if followed, would without doubt tend to keep the person free from the dreaded diseas during an epidemic.

THE SHAKERS. By C. E. Robinson. East Canterbury, N. H. 1893. 8vo. Pp. 134. Illustrated. No index.

The full title of the work is "A Concise History of the United Society of Believers called Shakers." There is always more or less interest exhibited in communistic societies, and the aim of the present work has been to collect facts in relation to the Shakers, and state them so clearly that the world may know the true life and habits of this most singular people.

THE COMPASS. Edited by William Cox. Vol. II. 1892-93. New York: Keuffel & Esser Co. 1893. 8vo, cloth. Pp. 192. Illustrated. Price $1.75.

The subscription price of the journal is $1.00 a year. The *Compass* is devoted to surveying, mechanical drawing and mathematics. New instruments, formulas, etc., are described. The journal is handsomely printed in blue ink and is well illustrated. The *Compass* is very carefully edited, much more so, in fact, than many journals of larger size.

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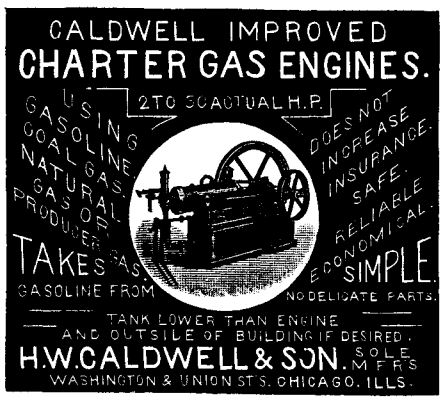
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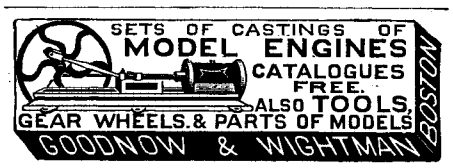

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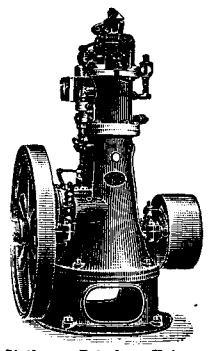

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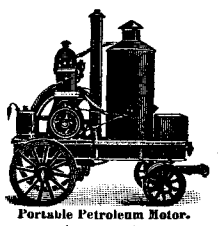

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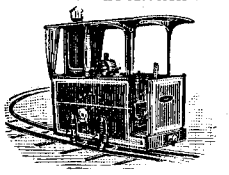

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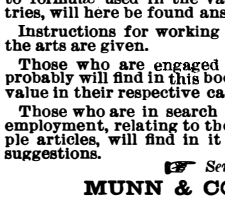

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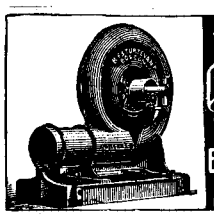

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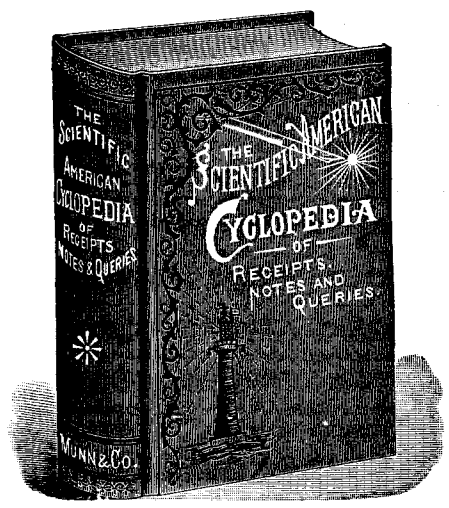

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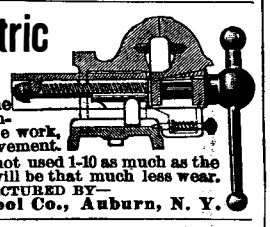

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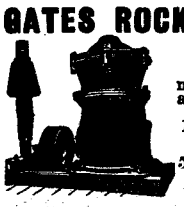

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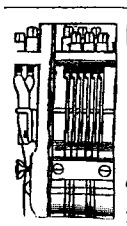

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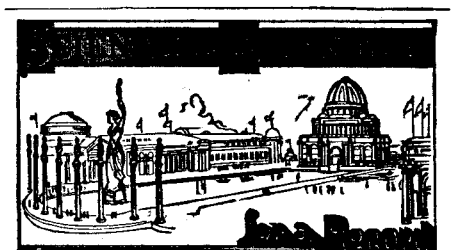

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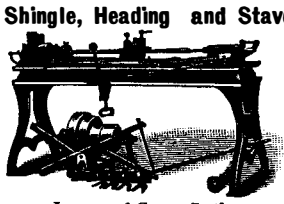

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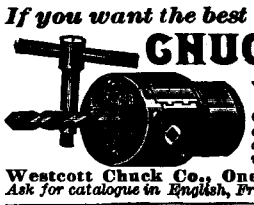

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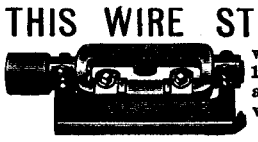

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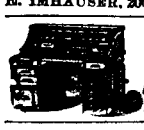

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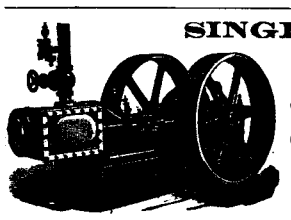

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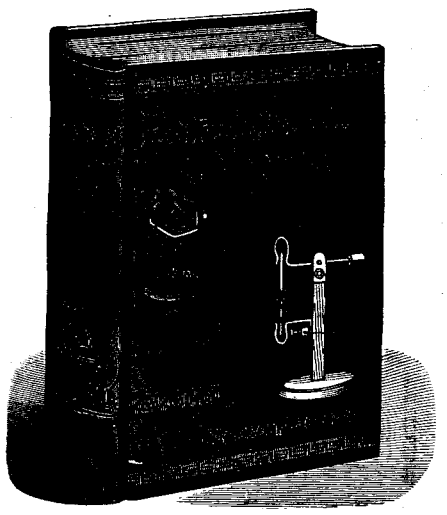

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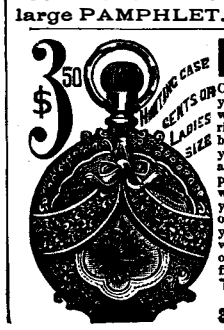

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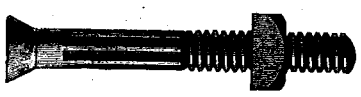

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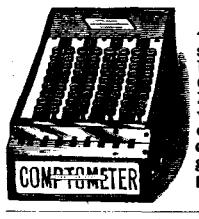

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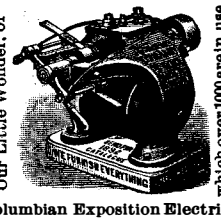

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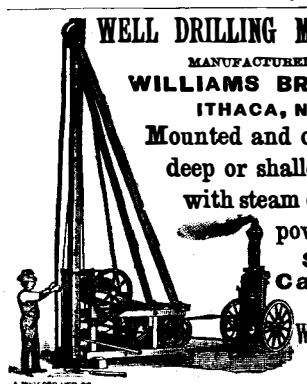

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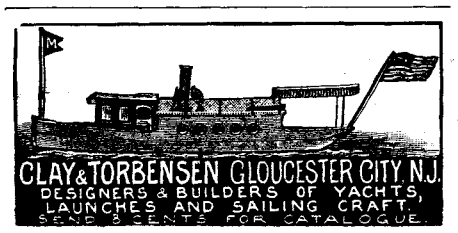

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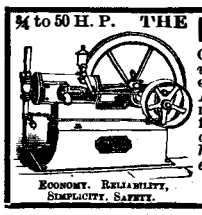

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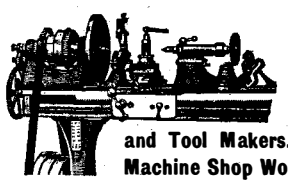

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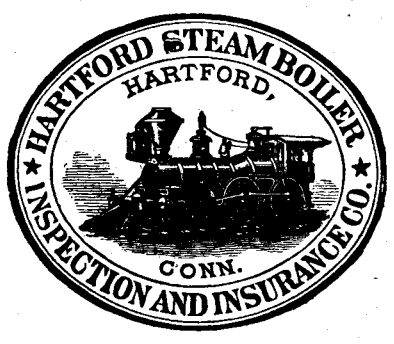

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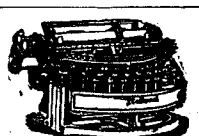

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